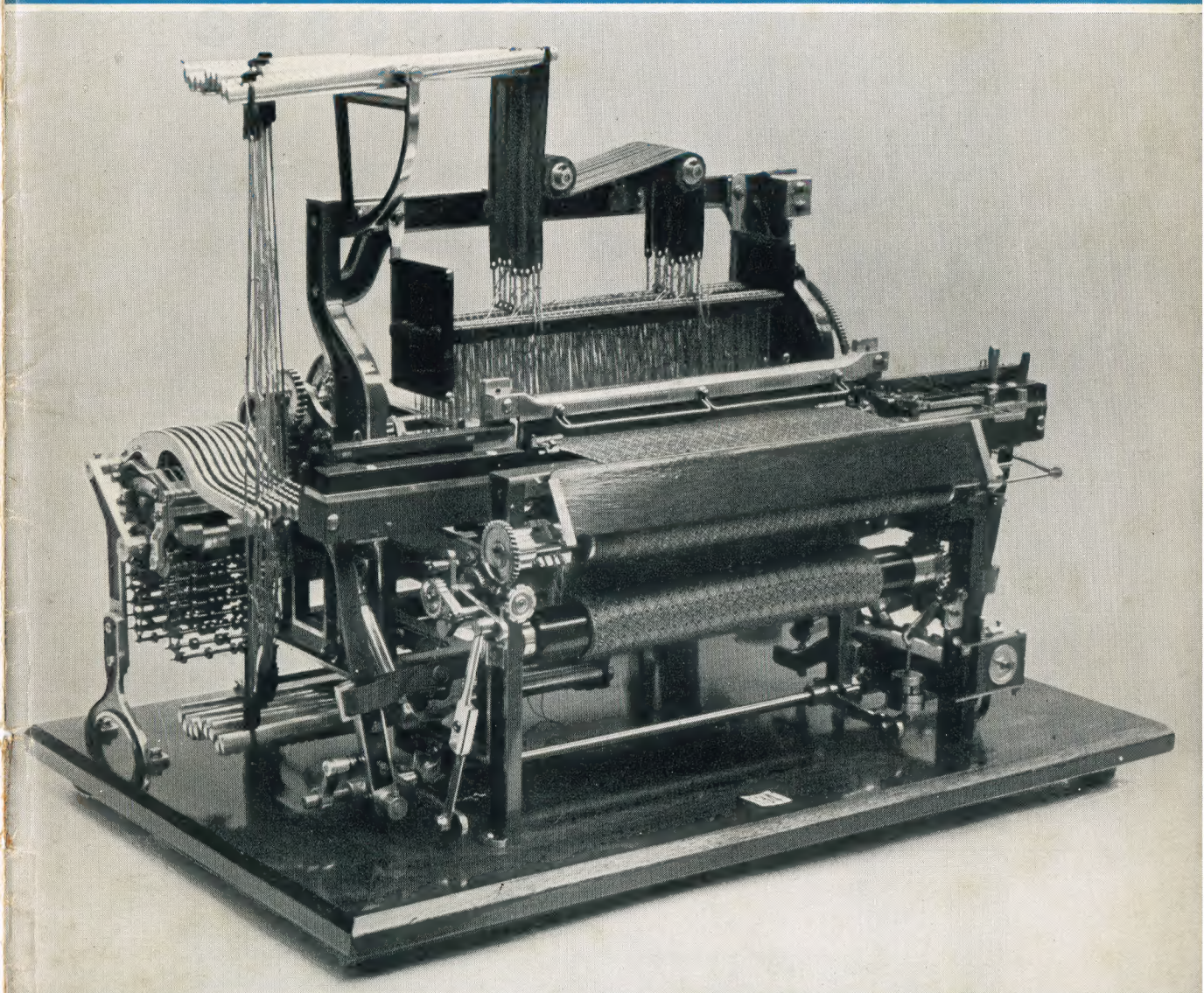
THE MODEL ENGINEER



IN THIS ISSUE

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THE
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CONTENTS

Our Cover Picture

Although many working models of the older types of manually-operated looms have been made, models of modern power looms are comparatively rare, and the example shown in this photograph is practically unique in reproducing the full working detail of its prototype. It was built by Mr. J. Worswick, of Oldham, over a period of eight years, working with simple equipment, including a home-made lathe and a hand drilling-machine. Not only the patterns, but also the castings, were produced in the home workshop, mostly in aluminium alloy, and the finish on the working parts in this material is so high that it can be mistaken for electro-plating. The gears were cut in the lathe, using home-made cutters.

The machine is driven by a 1/100 h.p. electric motor, and produces cloth of fine texture, the pattern of which is controlled by the same means as in full-sized looms. It was exhibited and demonstrated at the Northern Models Exhibition, Manchester, where it gained two of the highest awards.

SMOKE RINGS

The Duke and the Designers

H.R.H. THE DUKE OF EDINBURGH has been graciously pleased to indicate, in a letter sent from the s.s. *Gothic*, that he will be happy to receive at Buckingham Palace, two or three members of the Presidential Panel of the Institution of Engineering Designers, on Friday, June 4th. On that occasion, H.R.H. will accept the Diploma of Honorary Membership of the Institution as the official token of his recent election. This is a further indication of the Duke's keen interest in engineering.

The New Romford Track

THE ROMFORD Model Engineering Club has recently completed the construction of a new passenger-carrying track, to replace the one that was inaugurated by the late Mr. Percival Marshall in June, 1935. The new track is situated in pleasant surroundings at the rear of the club's workshop at the Red Triangle Club, Lambourne Hall, Western Road, Romford, and will be officially opened by Mr. R. A. Riddles, C.B.E. on Saturday, May 8th. Mr. Riddles, designer of the full-size *Britannia* and other B.R. locomotives is known to many of us through his interest in small locomotives, and it is hoped that he will be able to use Mr. H. Buckle's 3½-in. gauge *Britannia* at the opening ceremony.

The new track accommodates 1¼-in., 1¾-in., 2½-in., 3¼-in., 3½-in. and 5-in. gauges. It is of all-steel construction and is built round a kitchen garden and tennis court. The circuit is 570 ft.; the minimum radius is 51 ft., and all gradients are 1 in 192, which indicates a considerable improvement upon the club's pre-war track at North Street.

After some experience of running with two or more locomotives, some form of signalling was found to be desirable, owing to the driver's view ahead being restricted by hedges and bushes; seven 3-aspect colour-light signals are therefore being installed, and every effort is being made to have them ready for the opening ceremony.

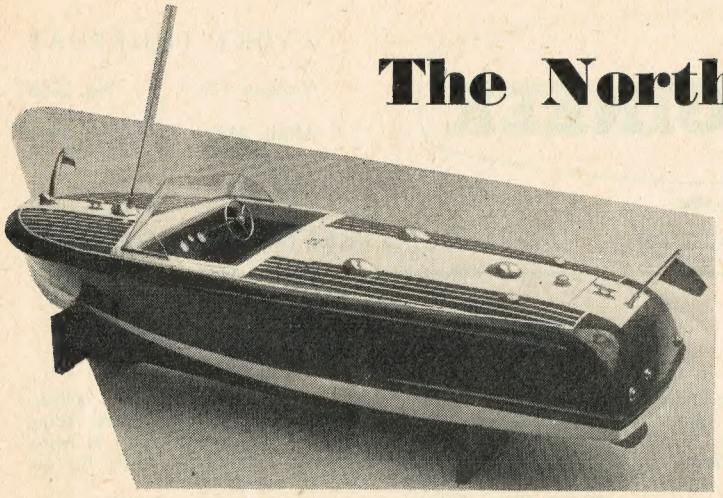
Canadian Enthusiasm

IN THE course of a letter about quite a different matter, Mr. J. E. Biggerstaff of Winnipeg, Canada, states that he and his wife came to Britain for the Coronation, last year; but he regrets that he was unable to find time to visit THE MODEL ENGINEER offices. He went to the Science Museum, however, and thought that the models there, working on compressed air were wonderful. This was the type of model he wanted to build! So he went to see Mr. Moldon, of Vernon Smith & Son, Hammersmith, and acquired a Corbett shaper, Pool's milling machine, reamers, cutters and chucks for his lathe. He accepted an invitation to visit Stuart Turner's plant and bought a complete line of their castings which he thinks are the best he has ever seen; he adds: "Thanks to THE MODEL ENGINEER, I think I have the finest private machine shop in Western Canada. Now you see what THE MODEL ENGINEER really got me into, because it was the little book that started all this. Long may it continue; thank you, and the best to you and all the staff."

Change of Name

THE FORMER West Cumberland Society of Model Engineers has recently changed its title to: The Cumberland Guild of Model Engineers and Craftsmen. The guild's headquarters are in Maryport, which is in an industrialised district, and the change of title has been made so as to permit the encouragement of model making and craftsmanship of all kinds, particularly among the apprentices who, after all, are the craftsmen of the future.

The Northern Models Exhibition



Reported by "NORTHERNER"

This nice-lined speedboat is built by a Brierfield schoolboy, J. Horne, and has won two awards.

AT any exhibition, it is always the case that there is much more worthy of description than there is room to describe, and it is always difficult to know what to leave out. This year's exhibition organised by the Northern Association of Model Engineers was no exception; there were so many fine models there, and it is a great pity that one can't mention them all.

However, since this is to be a preliminary report only, with more notes to follow later, let's pick a few out at random as we go round.

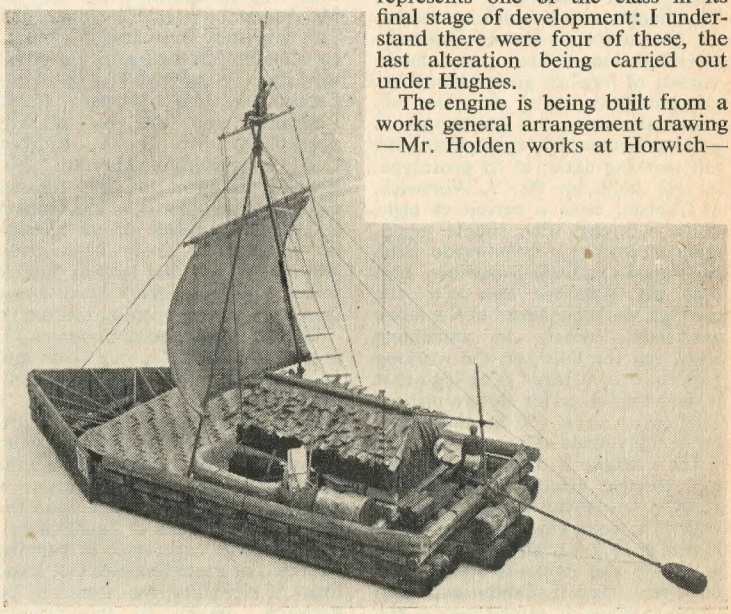
First of all, on the Junior stand is a motor launch built by J. Horne, a schoolboy from Brierfield. It is of hard chine construction, of thin ply on formers and stringers, and has nice lines. The finish is good, but more filling and rubbing down would have made it even better, and there are one or two "runs" in the maroon and cream cellulose finish. Considering the age of the competitor, the detail work is very good indeed; the cockpit has a bench-type upholstered seat, a neat car-type steering wheel (but I hope it won't be left with a brass finish !), and a dashboard with well-drawn instruments.

The engine-room looks good, too, with a water-cooled engine which appears to be a commercial diesel with a "home-fitted" water-jacket. The water-scoop is just aft of the propeller, and the return-pipe is led to the transom The twin exhausts are each fitted with an expansion chamber, and are led to the transom, too; aft of the engine is a perspex box which is to contain radio control apparatus.

This excellent model won the First Prize in its class, and also the Lawton Trophy; a well-deserved triumph for its builder.

Another good model in the Junior section was of the Kon-Tiki raft of Thor Heyerdahl and his gallant companions. R. E. B. Arthur, aged 15, of Bolton, was Highly Commended for this realistic piece of work. It is to ½-in. scale, as near as can be judged from dimensions given in the book describing the exploit, and is built as the prototype with pegs and lashings to secure the parts together.

The cabin walls are woven, and the roof thatched imitation banana leaves, whilst the "deck" is covered with matting woven from strips of paper. Details include a water-tank fishing tackle, pots and pans, tub, aerial, and dinghy with paddles.



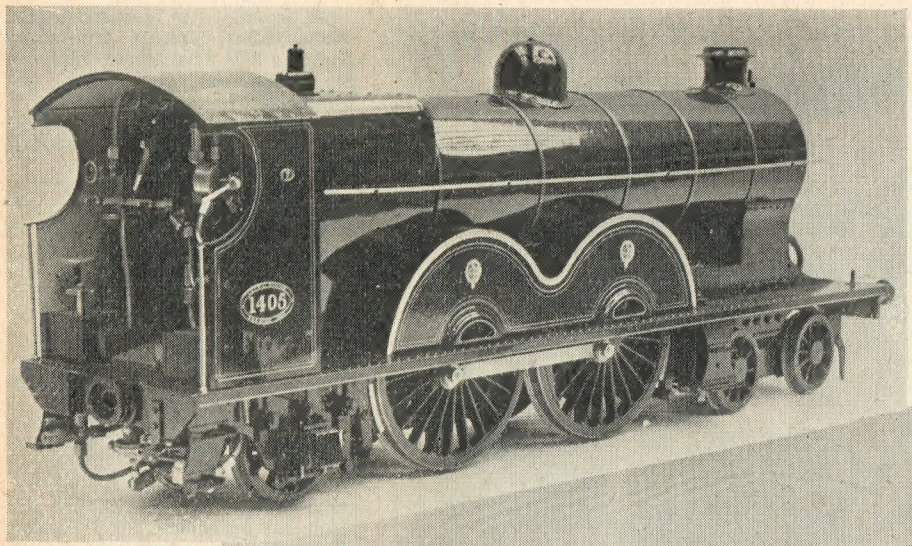
The first model built by Mr. Arthur's son Raymond is of the raft "Kon-Tiki"

A "Different" Loco. Model

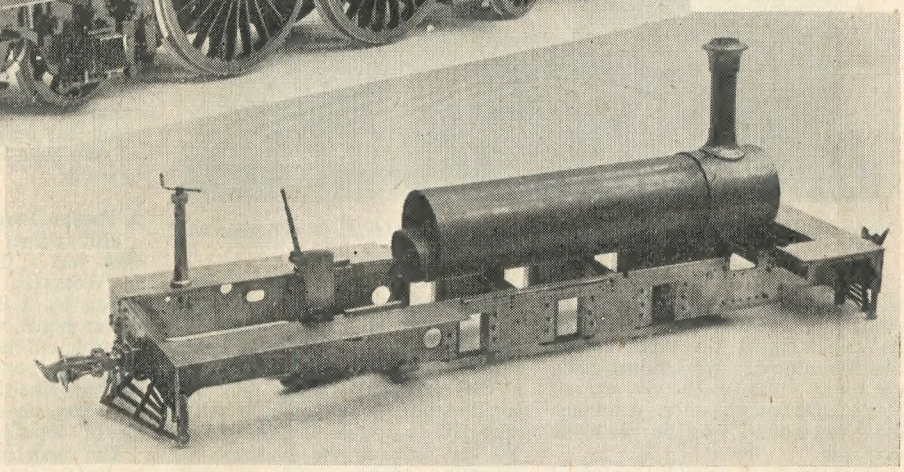
In the old pre-grouping days, there were many nice liveries, and many grand locomotives; not the least of either were the inside cylindered "Aspinall" Atlantics of the Lancs and Yorks Railway in their gleaming black coats.

A member of the Blackburn club, Mr. E. F. Holden of Oswaldtwistle, is building a fine replica of one of these engines, which won First Prize in the "Uncompleted" section. It represents one of the class in its final stage of development: I understand there were four of these, the last alteration being carried out under Hughes.

The engine is being built from a works general arrangement drawing —Mr. Holden works at Horwich—



Left: Mr. E. F. Holden is making a fine job of his L. and Y.R. "Aspinall" Atlantic. Note neat backhead and fine lining



Right: An interesting narrow-gauge loco in course of construction by Mr. W. E. Baxendale of Darwen

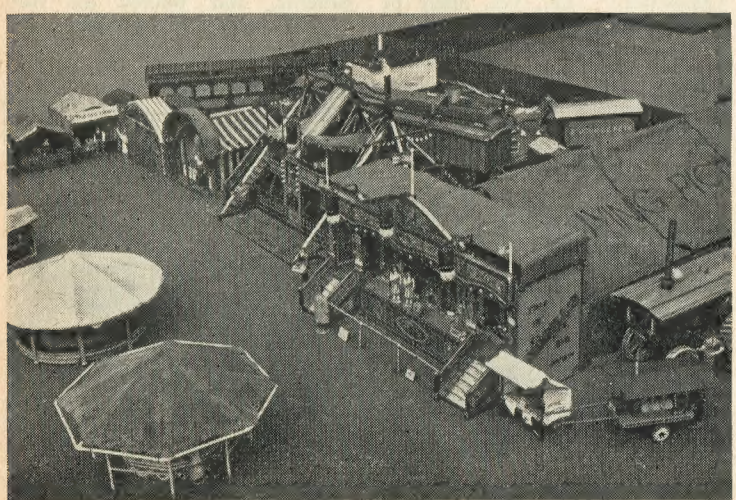
and the finish and detail are really something to see. The backhead is very neat, and includes a quadrant type regulator which is connected to a sliding bar extending across the backhead. A handle is fitted near each end of the bar, so that the regulator may be controlled easily from either side of the cab.

Joy valve-gear is fitted, and the inside motion is equally neat, well-finished, and detailed. As to the paintwork, it is beautifully done; the lining in particular is very delicate, and as good as any I ever recall seeing. "Transfers" of the company's coat-of-arms are fixed to each splasher; these were photographically reproduced and tinted with water-colour. A further adornment which adds to the realistic appearance is the delicacy of the engraved number-plates, also incorporating the company's name, on the sides of the cab.

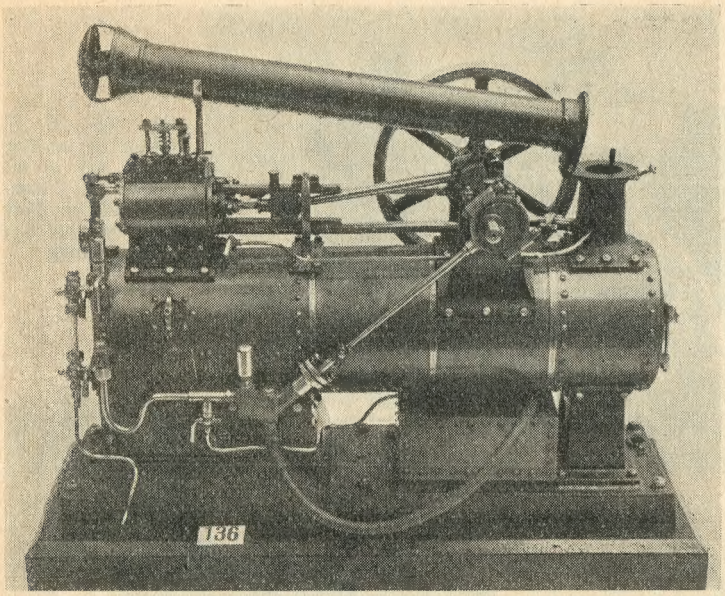
When this engine is complete with its tender, it will revive many memories—indeed, it already has done !—and if she works as well as she looks, Mr. Holden will have an engine to be *really* proud of !

On the stand of the Darwen Society there was a partly built locomotive of the Lynton and Barnstaple Railway; another engine with a difference which bids fair to being a winner ! This model is being built to 1¼-in. scale, which with the narrow-gauge gives a 2½-in. track.

Mr. W. E. Baxendale started building her before the Hitler war,



A small section of Mr. M. C. B. Arthur's Old English Fairground model



Single-cylindered overtype semi-portable engine built by Mr. F. W. Westmoreland of Altrincham

with very little tackle but a lot of enthusiasm. Not having a lathe then, he concentrated on parts which didn't need one: frames, hornblocks, couplings, "cow-catchers," and so forth. Incidentally, those couplings are a work of art, and they do work correctly.

Here again the builder obtained drawings of the prototype from the makers, and all the detail is to be as near perfect as his skill allows and "working" requirements permit. Mr. Baxendale is taking his time over the model; as he says, other jobs keep obtruding, but that is the common lot of the model engineer! So long as the job is completed eventually, he will be happy.

Other examples of Mr. Baxendale's work on the Darwen stand were in one-inch scale, including hydraulic buffer-stops and solenoid operated points. The latter are operated by a Ford trafficator unit; as the points change, a colour-light signal by the track is altered, and indicator colour-lights on the switch are altered too. All these fitments are made either from scrap or "surplus" materials.

A Fairground Model

One of the most attractive models in the exhibition was a fairground built by Mr. M. C. B. Arthur of Bolton, who was awarded the Member's Cup, as well as First Prize in his section. The model is really a whole series of models, for it includes side-shows, road-locomotives, living-vans, helter-skelter, gallopers, carrying-vans, and all the vast impedimenta of a complete English fair of the period 1903-1913.

The photograph shows only one small section of the layout, which is modelled to a scale of $\frac{1}{4}$ in. to 1 ft. To the right is the bioscope, or travelling cinema, with its well-illuminated mechanical organ, bravely stated to be the "largest in the world." Parked alongside are the Burrell and Fowler showman's engines, the former rocking gently—and most realistically!—as she "generates." Oh, yes, many of these models work!

On the left of the bioscope are the steam yachts, bearing the names *Lusitania* and *Mauretania*, whilst in the background are some of the living-vans. Lines of washing, water-tanks, piles of coal, dogs, a bicycle, buckets, and much other detail is included in the living-quarters.

But apart from the movement, the light, and the detail, what adds most to the realism of this fairground in miniature is the decoration. The scroll-work, the fancy lettering, the illustrations of "Fatima" (48-stone but nothing offensive), the tiny placards ("2d. all classes," "come in please, go out pleased"; remember them?). All these are superbly carried out.

Mr. Arthur is a veritable artist, and his knowledge of the fair-ground is second to none, I imagine. In this magnificent model he has combined the two talents, and the result has enchanted and delighted all who have been fortunate enough to see it.

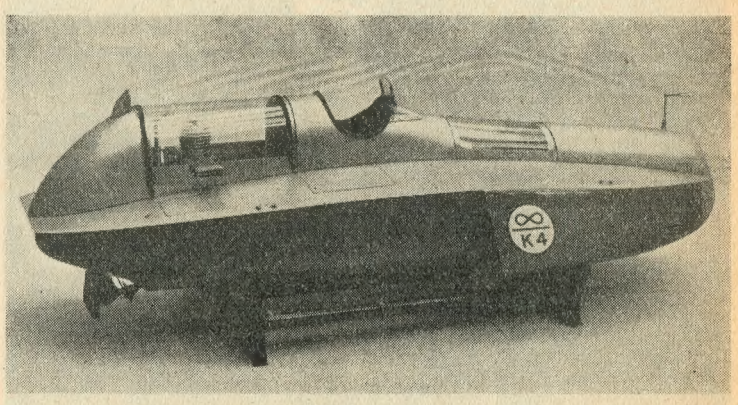
A Fustian Loom

Still another model in the unusual class was a fustian loom built by J. Worswick of Oldham. It is driven by a one-hundredth horse-power motor, with neat push-button control, and has a 10-in. reed space. There are positive take-up and let-off, and nine shafts; all of which to my inexperienced eye adds up to a lot of complicated mechanism!

The model has taken eight years to build, and has been done with very limited equipment, to wit, a home-made plain lathe and $\frac{1}{4}$-in. hand-driven drill. In fact, not having made the lathe in the early stage, the crankshaft was fabricated.

Mr. Worswick made his own patterns, and poured his own

(*Continued on page* 460)

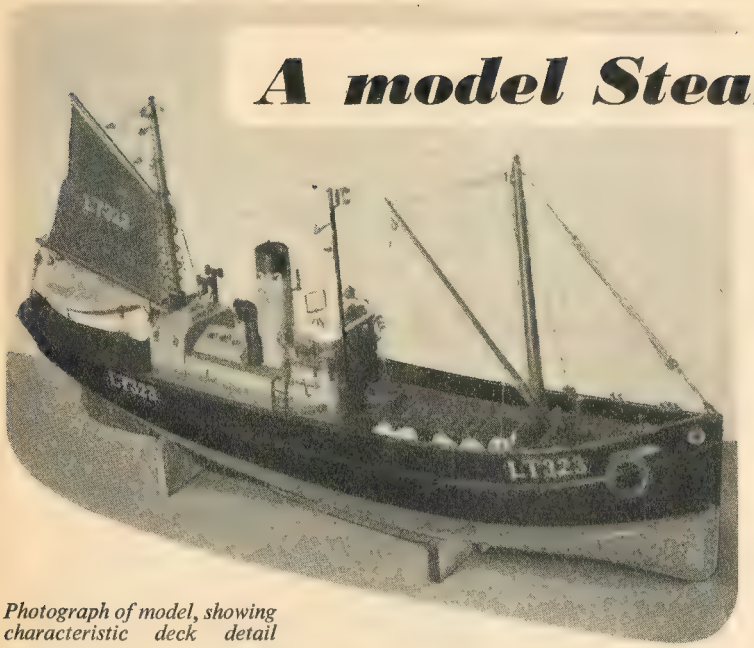


An uncommon hydroplane model: Captain Campbell's Bluebird II, built by Mr. L. Oldfield of Huddersfield

A model Steam Drifter

BASED ON A LOWESTOFT FISHING CRAFT

By L. W. Burcham



Photograph of model, showing characteristic deck detail

HAVING a piece of pitch pine handy the two masts were turned to size from it; the sail and derrick booms being much smaller in diameter these were turned from beech, the fork ends being fashioned by hand to fit their respective masts. The foremast base is finished square to fit the tabernacle, the after mast being round and fits into a metal socket bolted to the top of the galley roof and stayed with wire stays. The sail was made from an odd piece of trouser pocket, the grain of which was as near as possible true to pattern. After hemming it was dyed a reddish brown in a mixture of indian ink, the colour being the result of the usual " trial and error."

One additional metal mast is fitted to the starboard side of the wheelhouse to carry navigation lights, wireless aerial, etc., and is necessary because the forward mast is normally carried lowered on to the wheelhouse top when at sea.

Lifeboat

Experiments were made with a planked lifeboat, but eventually my second son, a puppet enthusiast, made one from the solid with carved planks and this small contribution was very gratefully received (Fig. 5). The life lines were pegged into holes drilled into the bulwarks. The boat is secured on two wood cradles and tied down with ropes through holes in the ends of the cradles and flat metal hooks hung on to the gunwales.

To construct the fish hold hatch (Fig. 4), two rectangles were made from aluminium strip, one $\frac{3}{4}$ in. the other $\frac{5}{8}$ in. wide by 20-s.w.g., one to fit inside the other, with a piece of formed aluminium angle running right round to form a flange to fit the deck. The three pieces, with their butt joints at opposite ends are riveted together in one assembly. The hatch cover was made of a thin piece of beech cut to fit the $\frac{1}{8}$-in. groove formed by the two rectangular pieces. In the acutal job the hatch is battened down with canvas and steel slats, but as ready access is required to the hull interior at this end this part was not fitted. Fish pond boards are normally fitted around the hold to divide the space each side and forward to form compartments where the fish are tipped from the nets and sorted before stowing.

A piece of phosphor-bronze from the scrap box proved to be just right to make the propeller, I had no details of shape to guide me so had to cut and file until the shape appeared satisfactory, whether it will function as well as it looks remains to be seen as time has not permitted any sailing trials.

To make the rudder (Fig. 4), a piece of $\frac{1}{8}$-in. brass plate $\frac{5}{8}$ in. wide was cut with three lugs on one edge, the other edge being grooved to take the rudder plate of $\frac{1}{16}$-in. brass. The two were brazed together and cut and shaped to the correct shape. The stern post having already been constructed with the keel, the rudder was secured in position with a toolmaker's clamp, and a drill passed down through the aligned lugs. Three pins with bolt heads were then fitted friction tight to serve as hinge bolts. The top of the rudder was drilled and tapped 6 B.A. to take the turned down end of the $\frac{3}{16}$-in. stem, the top of this stem being threaded 2 B.A. and the rudder beam nutted to it. The whole assembly is friction tight throughout and as mentioned previously, the rudder chains are not called upon to hold the rudder in position, being fastened to the beam and laid along the chain channel on port and starboard sides and turned into the wheelhouse casing.

The eight single sheave and eight double sheave blocks (Fig. 2) having already been made, a start was made to rope the sail and masts. The string used was some I bought at Woolworths and proved very satisfactory in size and weave, the string being dyed the same colour as the sail. All loops and ends are made off with fine thread and secured to appropriate horn cleats. The sail rings were made from $\frac{1}{16}$ in. square copper wire, with joints brazed, and then sewn on to the sail. In the full size job these rings are constructed of wood.

Constructional work being practically complete, the paint pots came out. The general practice is to grain the casing in the most elaborate manner and it seemed a simple matter to follow suit, but woe is me, every attempt was a wash-out and the job was finally finished as a brushing grain. The portion of the hull below water line was given a final coat of red oxide and the upper

(*Continued from page* 429, *April* 22, 1954).

part, together with the top of the funnel, ventilators and chimneys two coats of black. The masts, etc., were all painted with two coats of shellac varnish. The registration letters on the hull and sail were first cut as stencils and having once obtained a fair outline, the letters and figures were tidied up with a small brush. The draught figures fore and aft were painted on with a pen using white drawing ink, and judging by the difficulty I had to rub out an error, they should be fairly durable in water.

So far so good, the next problem was to power the craft, the original idea was to fit a steam unit, but owing to the lack of width in the beam, this was found to be impracticable. The only other choice was electric drive. Having an ex-R.A.F., 24 volt motor to hand, by trial, I found that it was too fast, and lost speed when loaded to an extent likely to be met in sailing. To overcome this a train of gears was salvaged from an old Aron electricity clock meter. In passing I might add that these gears are a first-class example of the type of work put into meters in the days when craftsmen had a chance to show pride of skill in the work they turned out. The gear train was assembled on a $\frac{1}{8}$-in. brass angle-plate (see Fig. 3), with its base wide enough to mount on to the bolts already fitted in the hull. The governor gear of the motor was first removed, and the motor mounted to the angle plate with 5-B.A. screws into the three holes existing in the motor frame. The first pinion was then mounted on the shaft protruding through the plate to mesh on to the first wheel of the gearing, the final drive being through a short shaft pinned each end to fit slotted brass collars.

The battery problem is a weighty one, and although this unit runs very well on four 4.5 volt torch batteries, I have had no experience of their lasting power when in use. They will probably prove a little more expensive than steam. Personally I am not very concerned about the sailing part, I am well satisfied with the construction side.

And so ends my first experiment in ship building, it has provided me with many happy hours of spare time work, and at its first showing at a recent Electricity Board Hobbies Exhibition gained a third in competition with a $\frac{3}{4}$-in. scale *Britannia* locomotive, etc. In my next effort I have the advantage(?) of a general arrangement drawing of a drifter/trawler which the owners kindly loaned me to take details off.

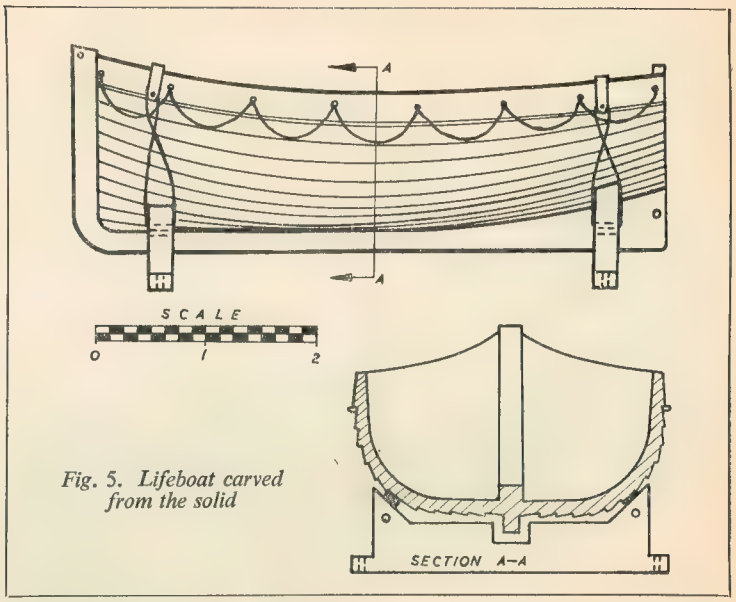


Fig. 5. Lifeboat carved from the solid

In conclusion I might add that *Faithful Star* senior has been, to all intents and purposes "re-built." The owners have considered it worth while gutting the hull and putting in diesel plant with modern streamlined casing and wheelhouse, not forgetting h. & c. and plumbing fit for a council house, this not before time, as an old oil drum and a bar of wood is hardly up to 1954 standards. The hull by the way was built in Lowestoft and launched in 1927.

THE NORTHERN MODELS EXHIBITION

(*Continued from page* 458)

aluminium castings from scrap metal —an old Morris sump and pistons are incorporated in this loom! Most of the other metal parts are also in aluminium, and are highly polished. With touches of green paint and a beautifully made mahogany baseboard, the whole effect is very pleasing.

All gears were cut by the builder in the lathe, using home-made cutters. I saw the machine at work, and very fascinating it is to watch; the cloth being woven is in green and natural colours. This is Mr. Worswick's first model, by the way, but it won him two trophies —the Myford Trophy for the best exhibit in the show, and the N.A.M.E. General Models Trophy, as well as First Prize in its class.

Out of all the other models, let's just pick a couple to complete this preliminary survey. The first is an overtype semi-portable engine, built by F. W. Westmoreland, of the Altrincham M.P.B.C. A single-cylinder slide-valve type, it has a crank turned from the solid, and a marine-type big-end. Details include cocks to indicate high and low water-levels, as well as a water-gauge (common portable engine practice), water-pump with air vessel (not common practice), a blow-down cock, and neat fire-door.

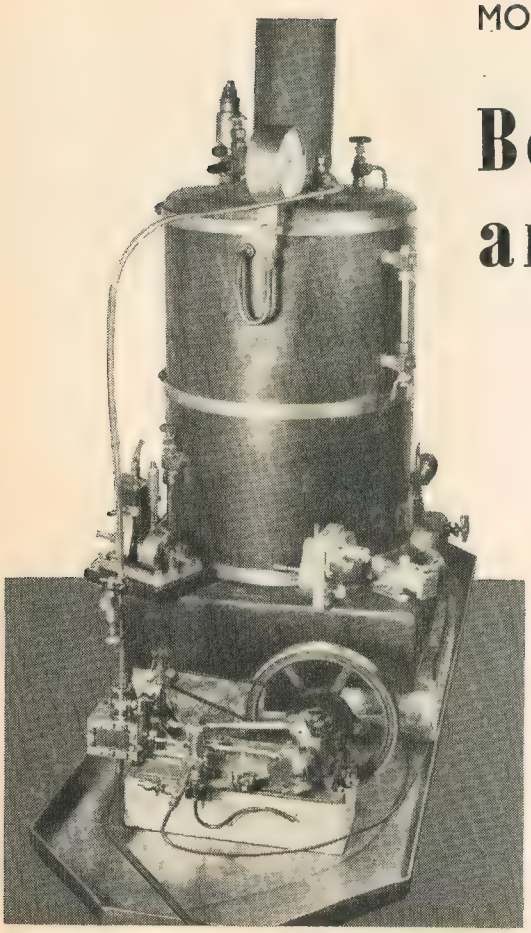
Marine models were well to the fore this year, and the quality was appreciably better than in 1953. I hope to illustrate and describe more of them later, but here is one to be going on with. It is a scale model of Captain Campbell's *Bluebird II*, and won First Prize in the Hydroplane and Speed Boat class.

Built by L. Oldfield of the Huddersfield Society, it has an excellent finish in the blue and silver of the original. A diesel engine is fitted behind the cockpit, driving forward to a gearbox, from which the propeller shaft projects aft. Clear celluloid panels are fitted over the engine and gearbox for display purposes, but are presumably replaced by metal for running. Lugs are fitted for running the model round the pole; I have no information on the speed achieved, but she should look well in the water.

MORE UTILITY STEAM ENGINES

Boiler Design and Construction

By Edgar T. Westbury



The Blakeney test boiler, with the "Unicorn" engine connected up, and other utility engines awaiting test.

THIS subject has been given priority over further engine designs, because of the many requests for information thereon which have been received from readers. Although a great deal has been published in THE MODEL ENGINEER on both the design and construction of small boilers of every type, and the various problems associated with them have been discussed *ad infinitum*, it does not follow that the last word has been said—and I certainly do not intend attempting to say it. My observations, while not scorning or disregarding theory, will be concerned mainly with the practical aspect of producing boilers of a type suited to generating steam for the engines which are described in this series of articles, and also the first series, published some five years ago.

Continued from page 399, *April* 15, 1954.

The boiler might be described as the "Achilles' heel" of the steam engine; it is the least interesting part of the plant from the aspect of mechanical engineering, demands more care and attention than the engine itself, and frequently proves the limiting factor in the overall efficiency, or even fails to fulfil its intended function in some important respect. How happy we should be if we could dispense with boilers altogether! The steam engine would then be the simple and straightforward source of power which some people believe it to be, and almost ideal for all our model engineering requirements. It is, however, possible to eliminate the boiler only by putting something either far more complicated or less efficient in its place; so away with wishful thinking, and on with the job.

There are many constructors of working model steam engines who have never built a boiler in their lives; their engines have been run on compressed air for demonstration purposes, or on exhibition stands, and this proof of their working qualities has been considered satisfactory and sufficient. But there are many applications of the small steam engine where it is absolutely necessary to make the entire power plant self-contained, such as in a model power boat, and in any case there is a thrill in operating a plant running on real steam, which is absent when other methods of applying pressure are employed. I know of many enthusiasts whose idea of complete happiness appears to be the management of a small steam plant, including the various jobs that it entails, including watching gauge glasses, pressure gauges, etc., stoking the furnace, and attending to engine lubrication.

There are, however, some aspects of steam plant management which are not so pleasant as this, and my own experiences, with full-size marine engines, have tended to emphasise the troublesome rather than the joyous side. Such jobs as crawling through the furnace into the combustion chamber to fit a "stopper" to a leaky tube while under steam; wrestling with a jammed stop-valve in a temperature of 135 deg.; or groping in semi-darkness in the effort to coax life to a reluctant feed-pump;—these hardly engender a love of boilers and boiler room accessories. But just like the sailor who curses the sea on the first day out of port, and yet cannot endure more than a week on dry land, the engineer keeps coming back for more punishment, and in many respects, a steam plant on a small scale enables one to enjoy the fascination of this form of motive power without its disadvantages.

A Simple Test Boiler

Several of my correspondents have asked my advice on the construction of a boiler, which can be used for the testing of engines under steam; the essential features being that its design should be fairly simple, but it should be capable of being brought into action fairly quickly, and producing an adequate quantity of steam at moderate pressure. Its use, of course, need not necessarily be confined to testing and demonstration purposes, but

this is its primary object.

Perhaps a few words on the boiler which I use for testing my own engines will be appropriate here. This was constructed many years ago by my old friend, the late Mr. S. E. Blakeney, with whom I had the pleasure of collaborating in the design of small steam engines, boilers and atomising burners before the war. The boiler was presented to the "M.E." workshop by his son, Mr. R. E. Blakeney, and has been found extremely useful for testing purposes. It is quite a large boiler of the vertical type, measuring about 16 in. high (less base and uptake) by 10 in. diameter, having an internal combustion chamber and central flue, with 16 bent water tubes. It is constructed of steel, with welded joints, and although it was out of use for a considerable time during and after the war, it shows no signs of pitting or other deterioration on any of the surfaces which are accessible for visual observation. Before putting it into use, however, I gave it a hydraulic test up to 160 lb. p.s.i., which was completely satisfactory, as it is not intended to work it at more than 100 lb. p.s.i.

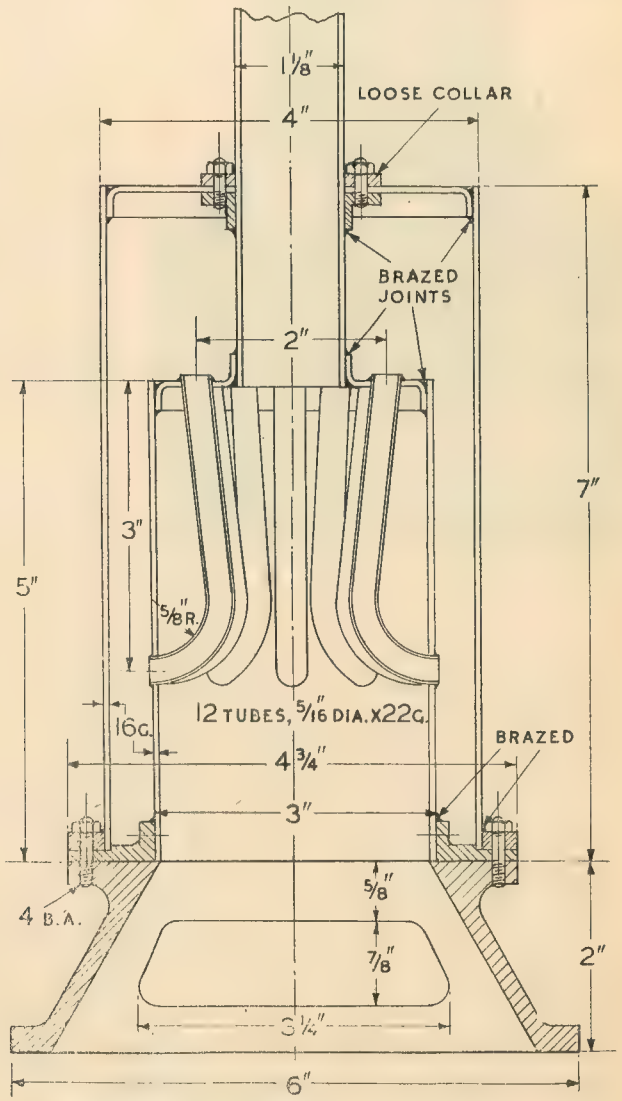
Firing

A Primus paraffin burner is fitted for firing, and the fuel is supplied from a separate container, with air pump, connected to the burner by a flexible metallic pipe line. The fittings include the usual boiler mountings, a feed water heater coil, and a superheater, though the latter is not in proper working order at present owing to a partial blockage which has so far resisted all efforts to clear it. As, however, it can be by-passed by using a separate outlet, and saturated steam is quite satisfactory for the tests which have been carried out so far, this has not been a serious disadvantage.

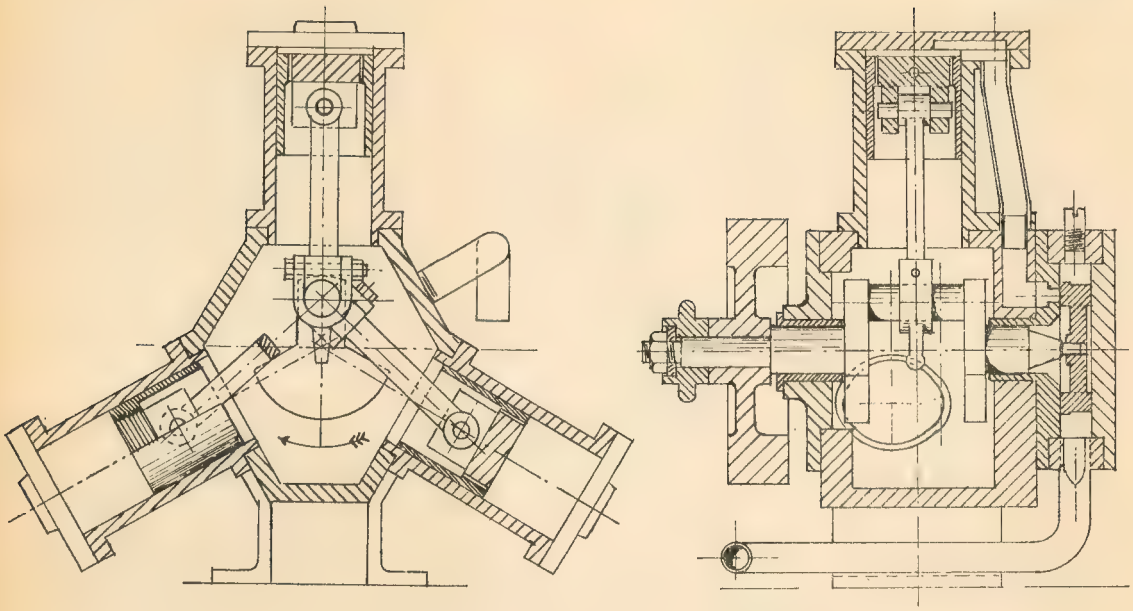
The ample size of this boiler is, of course a good fault, because it is quite a good thing to ensure that there is no deficiency in the amount of steam available, but most constructors will prefer to make a smaller test boiler, if only on the grounds of economy in material, work involved, and space occupied by the plant. The test boiler I describe here, as illustrated by the line drawing, should be quite adequate for testing and demonstrating any of the engines so far described in both series of these articles, if made to the dimensions specified, but it is, of course, quite practicable to make it either larger or smaller if desired.

In general design, this boiler has many features in common with the Blakeney boiler described above, but it is in no sense a copy of it, and differs considerably in the methods of construction. It incorporates neither a superheater nor a water heater, though these features can be added if desired; in view of the difficulty experienced with the superheater of the large boiler, which is completely inaccessible, and cannot be detached except by cutting away, I think there is much to be said in favour of making it a separate unit. No details of fittings are shown on the drawing, as they can be arranged to suit individual requirements. The material recommended is copper of 16-gauge, and this metal is preferred by most amateur boilermakers for convenience in working, though steel would be cheaper and possibly easier to obtain, while its suitability is proved by the long life of the large boiler.

If I can claim any originality at all for the design of this boiler, it



A small vertical boiler, suitable for steam tests of models, and other utility duties

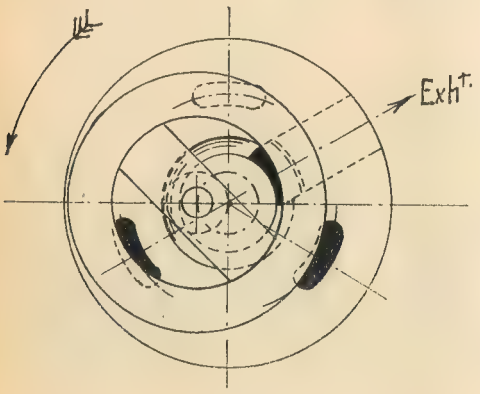


A three-cylinder radial engine inspired by the " Cygnet " design

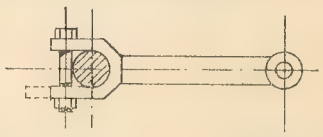
lies in the methods adopted in construction, and in the fitting of the water tubes, which constitute the major area of heating surface. It will be seen that the outer shell is so constructed as to be completely removable from the inner assembly; while not a new feature in itself, as there have been quite a few boilers, both model and full-size, where means of access to internal parts has been attainable by somewhat similar methods, they have often tended to complicate construction, whereas in this case it is very much simplified. This feature is, of course, optional, but even if the outer is to be permanently brazed or welded on, there is a great advantage in being able to carry out all the work on the internal assembly first, and if desired, to test the soundness of the joints, before closing all access to them. However, I think that there is much to be said for a boiler which can be opened up at any time for inspection and cleaning.

The water tubes are arranged so that they provide a larger heating surface than that which can be obtained in the orthodox fire-tube type of vertical boiler, while offering no obstruction to the flow of combustion gases, and they can also take full advantage of radiant heat. Being disposed mainly vertically, they facilitate circulation by convection currents.

A further feature of the boiler design which is somewhat unusual is the provision of a heavy, broad base to house the heating element, which is intended to be either a gas-ring or a vaporising oil burner of the Primus type. A solid-fired boiler is by no means so convenient for test purposes, as the process of lighting up and raising steam absorbs time and attention which usually can ill be spared. One difficulty in adapting this form of design to solid firing is that the fitting of a firehole door interferes with detachability of the shell; it would, however, be quite practicable to employ a separate firebox unit, with its fire door, entirely below the boiler itself, and the added depth of furnace would, if anything, improve efficiency by providing adequate combustion space.

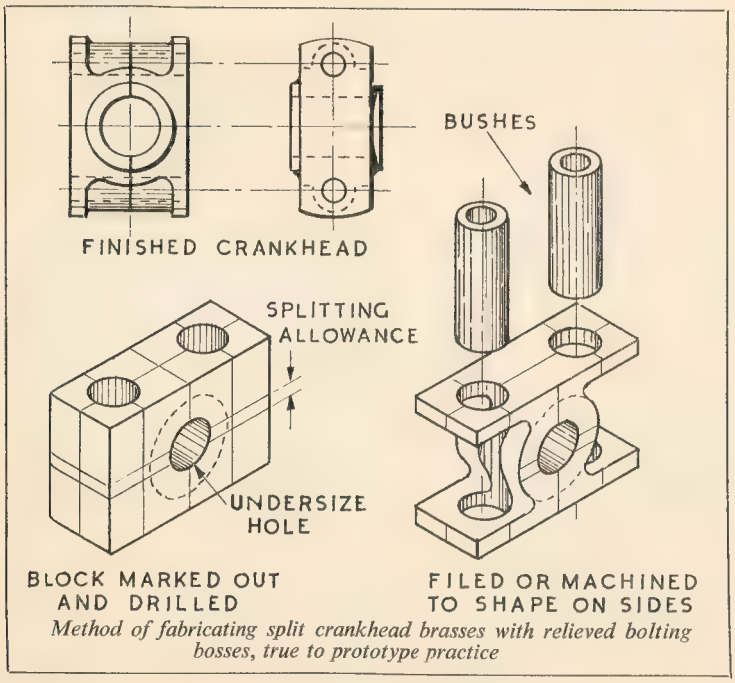


Enlarged view of port face (crank at T.D.C.)



Alternative form of connecting-rod

Solid-drawn tubing is, of course, most convenient for both the inner combustion chamber and the outer shell, but if this is not available, the tubes may be rolled from 16-gauge sheet and the joints dovetailed and brazed. The foundation rings, also the uptake flange, with its loose collar, may be made from castings and machined. Six $\frac{1}{8}$ in. or 4-B.A. studs will suffice for the uptake flange, but twenty-four of the same size should be used in the foundation ring, and gaskets of thin Hallite or Klingerit jointing interposed between the faces in each case. Note that the top flange of the base reinforces the strength of the foundation



Method of fabricating split crankhead brasses with relieved bolting bosses, true to prototype practice

ring, so that if any alternative method of mounting is employed, it may be found necessary to make this ring of thicker section.

The base should preferably be made of cast-iron, though aluminium alloy is permissible. It must have large air apertures as shown to provide adequate ventilation to the burner. If liquid fuel is used, I do not recommend incorporating the reservoir in the base; it is much better to keep it well away, where it is not affected by heat, and is readily accessible for filling.

For bending the water tubes, I recommend that they should be filled with lead or low melting-point alloy, after thorough annealing, and a grooved former having a throat diameter of 1¼ in. should be used. Two tubes can be formed at once from a piece of tube about 8 in. long, by bending it in the middle and bringing the two ends together, then cutting in two at the middle of the bend. If the tubes are loose in the plates when fitted, they may be expanded at the top end with a taper drift sufficiently to hold them in place while brazing.

Assembly

The brazing or silver-soldering operations on this boiler are of a comparatively simple nature, with all the joints readily accessible, and will, I hope, present no formidable obstacles to constructors who are inclined to approach boilermaking by the usual methods with some trepidation. I have encountered several cases of partial or complete failure to produce sound boilers, through troubles arising in internal joints which are impossible to get at when the job is finished; and also many others which, though sound and capable of fulfilling their function, are by no means "a thing of beauty and a joy forever" as the products of the model workshop always should be. I am blaming neither the boiler design, the constructional methods, nor the constructors for this, but it would be idle to deny that these things constitute formidable deterrents to boiler-making among inexperienced workers.

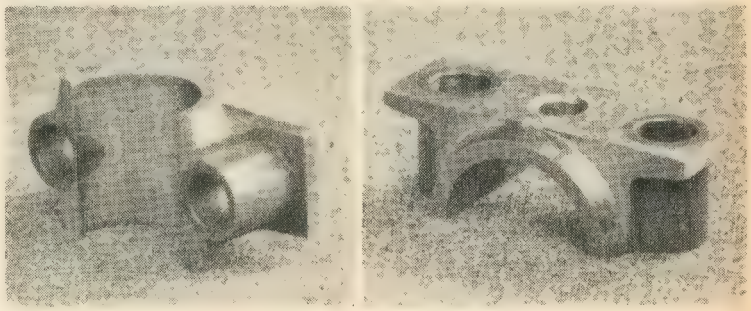
The inner flange forming the foundation ring, the uptake flange, and the base flange on the shell, should all be pinned in position by a number of radial pegs or rivets before brazing; this is not necessary for security reasons, as the brazing, if properly carried out, should produce ample mechanical strength, but to locate the parts, and not only prevent them shifting out of place during brazing, but also avoid gaps in the joints by local distortion of the parts. Using methods which have been described many times in THE MODEL ENGINEER, and an ample source of heat to obtain the required temperature quickly, the job should be, in popular terms "a piece of cake."

"Cygnet" Flashbacks

I have been very gratified by the success of the "Cygnet" engine, which has been built already by many readers, one or two of whom have paid tribute to its efficiency in the correspondence columns. The fact that it has attracted the attention of such past masters of model engineering as my old friend Mr. E. W. Fraser is regarded by me as a good testimonial to its design; and yet another friend, who insists on remaining anonymous, but is one of the best-known constructors of historic marine engine models, has found in it the inspiration for a modified design of engine which he intends to use as the turning engine for his larger models, which cannot conveniently be run under their own power, either on steam or compressed air, owing to the difficulty of keeping their intricate working parts in immaculate condition.

As these engines have to be self-starting, it has been necessary to add a third cylinder, which calls for modification of the arrangement, with somewhat increased complication, though the principle is exactly the same. A solid crankshaft, with bearings front and rear, was preferred, and this has entailed the use of divided big-end bearings,

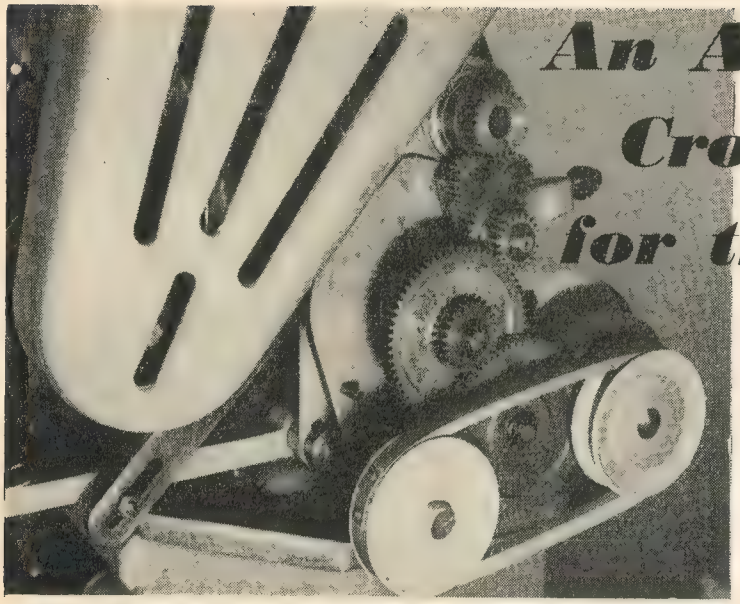
(*Continued on page* 466)



The finished crankhead brasses

An Automatic Cross-feed for the M.L.7.

By R. H. Pilcher



End of lathe with gear guard removed to show belt drive to back shaft

THE way that I set about the alignment of the whole affair is as follows:

First drill and bore the holes, fit the bushes, and assemble the upper spur wheel between the plates, leaving the plates only very roughly cut to shape. Now slide this spur wheel on to the extension shaft, which is in position on the lathe. and put the quill (on its shaft) through the lower pair of holes.

It will now be found possible to swing the whole gearbox around the extension shaft until the plate (*A* Fig. 1) butts up against the underside of the gib. Holes to match the gib are then drilled in *A* for securing. Afterwards the gearbox plates are drilled for the securing bolts attaching them to the cross-slide.

Finally the plates are trimmed to size and shape. By this method the proper meshing of all gears is assured. The arrangement is shown in Figs. 4 and 5.

It was found necessary to brace the two plates together for additional stiffness. This is shown in the photographs and was done by means of small distance pieces placed between them and a couple of set-screws. The whole of the "gearbox" was displaced from the end of the cross-slide by two distance-pieces, $1\frac{7}{8}$ in. long, as this gave practically the full amount of cross-feed both back and forth that was originally obtainable on the lathe, and two high tensile steel bolts, $\frac{5}{16}$ in. diameter, were used to secure the whole thing to the cross-slide, holes for the bolts being drilled and tapped into the end of the cross-slide without any interference with the normal functioning of the lathe.

(*Continued from page* 447, *April* 22, 1954).

Chip Guard

I was a little concerned about the effect that swarf and dirt generally might have on the gears, so decided to cover them up as best I could, in the first place by means of a simple 18- or 20-gauge brass plate bent over the two fixing bolts and their distance pieces, but of course this plate could not extend further down than the level of the saddle. I had intended to fix up a cover for the lower spiral gears, but in practice I found this quite unnecessary, as the brass plate shown in one of the photographs seems to protect the gears completely from swarf.

Main Drive

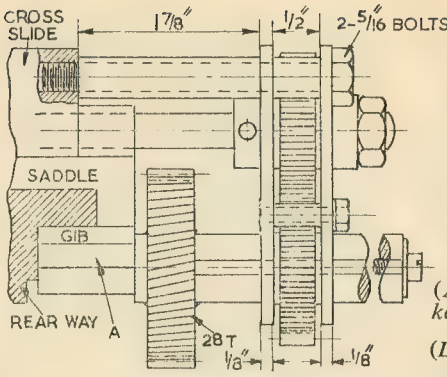
Regarding the drive end, I had intended originally to couple the leadscrew with the new cross-feed shaft by means of gears, but, partly due to laziness and partly due to lack of time I decided, at any rate

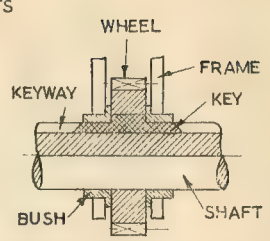
Showing how the gear guard is cut away to clear shaft

for the present, to use a belt drive, since it seemed extremely unlikely that I should ever want to cut a really accurate scroll. In practice I have found this belt drive to be more than adequate for its job, and details of it are shown in the photograph. It is, however, possible, and not at all difficult, to rig up a direct positive feed from the lathe spindle by means of gearing, and I have done this on one or two occasions, though I cannot think it is a requirement that is very often necessary.

One of the aims of this design has been not to interfere with the general construction of the lathe as it stands, and it will be seen from the above that so far it has only been necessary to drill a couple of holes in the back-end of the cross-slide to take the $\frac{5}{16}$-in. gearbox supporting bolts, to enlarge the motor platform trunnion holes, and to drill a hole which was exactly in line with the feed-screw at the back end of the saddle. None of these operations has in the least bit affected the lathe, and at the drive end again very little alteration was necessary.

The thin aluminium plate to which is fixed the lathe gear cover, had to be filed out sufficiently to clear the main feed-shaft, as shown in the photograph, and when the pulleys are not in use they can be simply slipped off





(Above) Fig. 6. Method of keying sliding gear to shaft

(Left) Fig. 5. Details of gearing

(they are secured only by Allen grub-screws), and the gear cover can then be replaced, provided a small section is cut away, again as shown in the photograph.

One point which is worth bearing in mind is with regard to the keys, which are made a tight fit in the wheel keyways, and are extended at the shaft diameter for quite a distance, so that they reach beyond the ends of the bushes. The ends of the keys are chamfered down, the effect being for the keys themselves to "dig out" any swarf that may have collected in the keyway, rather than to try to ride over it. An added advantage is, of course, that the wearing surfaces of the keys are greatly increased in area. Fig. 6 shows this.

Operation

In operation the attachment has proved completely satisfactory, but I always take this one precaution: After locking the saddle by means of the screw provided, I always take an eighth of a turn or so on the screw which secures the leadscrew split-nut control lever. This effectively prevents accidental engagement of the longitudinal self-act, when the saddle is locked.

MORE UTILITY STEAM ENGINES

(*Continued from page* 464)

also introducing some assembly problems, but these can be reduced by adopting the alternative form of connecting-rod shown. An important improvement in the design of the valve will be noted, in that instead of being subjected to full working pressure on its face, as in the original "Cygnet" design, it is almost completely pressure-balanced by making it a close fit between the port face and the flat rear cover of the steam-chest, a slight difference between the front and back face areas of the valve ensuring that it always has a slight positive pressure on the port face. It is of course, essential that the relief or cavity in the back of the valve has a communicating passage with atmosphere or with the exhaust port. The cylinders are staggered to avoid the need for offsetting the connecting-rods.

It may be mentioned that these turning engines, when fitted, will be concealed in the base of the models and must, therefore, do their work behind the scenes—"out of sight, out of mind"—but despite this fact, I am glad that yet another sphere of utility has been found for my utility engines.

Crankhead Brasses

The above friend has also sent me a pair of crankhead brasses of small size to illustrate a method of constructing them in accordance with full-size practice. It may be observed that the usual method of making the split brasses in model engines, in the form of a more or less rectangular-shaped chunk of metal, is not in accordance with usual practice in large engines, though it is serviceable and may not be unduly conspicuous. It is generally desirable, on the grounds of reducing weight, and also expense in bearing metal, to eliminate as much unwanted metal as possible in the castings of the bearings, but if this is attempted in model size it is rather difficult to get castings sufficiently neat and accurate to reproduce the shape effectively.

In the method recommended, the brasses are fabricated, starting by shaping a rectangular block, which is trued up to the required size, with splitting and finishing allowances, and drilled undersize on the main centre, and oversize on the bolt hole centres, to take the bushes which will form the relieved bosses. Before inserting them, however, the sides of the block are filed or machined away as shown, leaving only the end flanges and the central boss intact. The bushes are then silver-soldered or sweated in place, after which the block is split and faced, then bolted together for boring the bearing, and other finishing operations which may be required.

The appearance of the brasses when finished is seen in the photograph. It may be mentioned that this method of fabrication was employed by the late Mr. A. W. Marchant for the crank and crosshead brasses of his diagonal paddle engine which won a Championship Cup at the "M.E." Exhibition in 1936, and is now in the South Kensington Science Museum.

(*To be continued*)

IN THE WORKSHOP
BY DUPLEX

Constructing an Engraving Machine

THE engraving head is mounted on the limb *Aa* of the pantograph frame, so that its movements correspond to those of the tracing stylus. In building the head, accurate work is essential to ensure that the cutter itself runs truly and that the spindle rotates freely and without shake.

The Body—Ca

This part was turned from a length of 1¼ in. diameter mild-steel. The seating for the upper ball-bearing and the outer diameter of the shank portion are machined at the same setting in the chuck to ensure concentricity. With the part reversed in the chuck, the shank will then provide a datum surface for resetting the work to machine the lower bearing housing.

As the body has to slide in its mounting for the purpose of moving the cutter in and out of cut, it is advisable to leave the shank slightly over-size on diameter, so that it can finally be lapped to an accurate sliding fit.

The Spindle—Cb

The spindle is made of mild-steel, and should be turned between centres to ensure accuracy of alignment of the ball-bearing mountings. At the same time, the three threaded portions are screwcut to the same pitch of 40 t.p.i.

Continued from page 404, *April* 15, 1954.

Mounting the Ball-bearings

Standard, light-type ball-bearings are fitted, and the inner races of the two lower bearings are secured to the spindle by means of the threaded collar *Cc*; the outer races are kept from turning in the housing by the clamp-ring *Cd*, secured to the lower end of the body. When fitting these bearings, it is essential to check that both the inner and the outer races are of identical width, for some makes of bearings vary in this respect, and this would lead to setting up a side thrust on the balls on tightening the clamping collars. If necessary, therefore, shims must be fitted to make good any inequality.

The inner race of the smaller bearing at the upper end of the spindle is secured to the shaft by the nut *Ce*, but the outer race is left free to slide in its housing. This facilitates assembly, and also allows compensation for any alteration of spindle length resulting from change of working temperature. To keep out dust and to retain the lubricant, the upper bearing is sealed by means of the knurled cap *Cf*.

The Driving Pulley—Cg

For resisting wear, the small two-step pulley is best made of cast-iron. The V-grooves are machined to an included angle of 30 deg. to give a good belt grip, and the apex of the groove is relieved as an aid to machining.

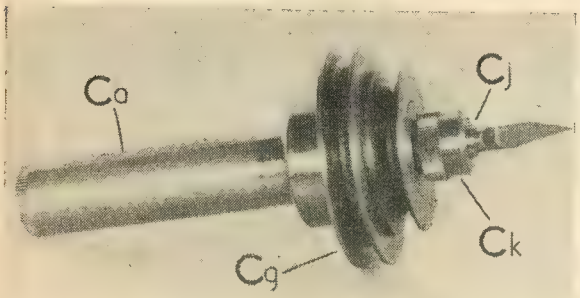
Two steps are provided, as the spindle speed may need to be varied for engraving different kinds of materials. The actual drive is by means of a round, plastic belt; this belting grips the pulleys well, gives silent running, and avoids having to fit a belt fastener. The ⅛ in. diameter belting used is obtainable from Mr. K. R. Whiston, who advertises in this journal; this material is supplied in diameters ranging from ⅛ in. to ⅜ in.

As this belting is somewhat elastic, the belt length can be varied over a considerable range without having to adjust the position of the drive units. The method employed for jointing these belts was fully described in a previous article, and it has been found that joints made in this way were quite reliable under working conditions. The driving pulley is secured to the spindle by the locking-ring *Ch*, and it should be noted that the direction of the drive is arranged so as to tighten this ring on the spindle.

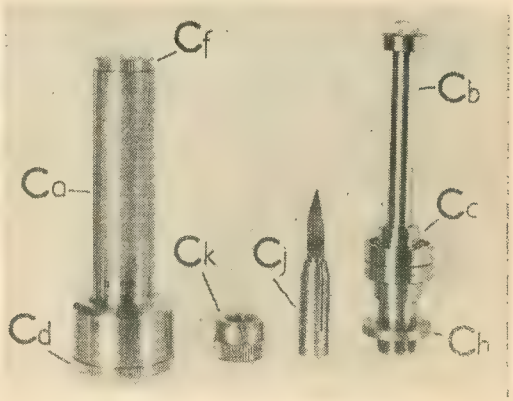
The Chuck

The engraving tool is gripped in a collet chuck fitted to the nose of the machine spindle, as shown in Fig. 21.

For the machining operation, the



(*Above*) *Fig.* 19. *The finished cutter head. Ca—the body; Cg—the driving pulley; Cj—the chuck collet; Ck—the chuck collar*



(*Right*) *Fig.* 20. *Cb—the cutter spindle; Cc—the bearing lock-collar; Cd—the bearing clamp-ring; Cf—the dust cap; Ch—the pulley lock-ring; Cj—the collet; Ck—the chuck collar*

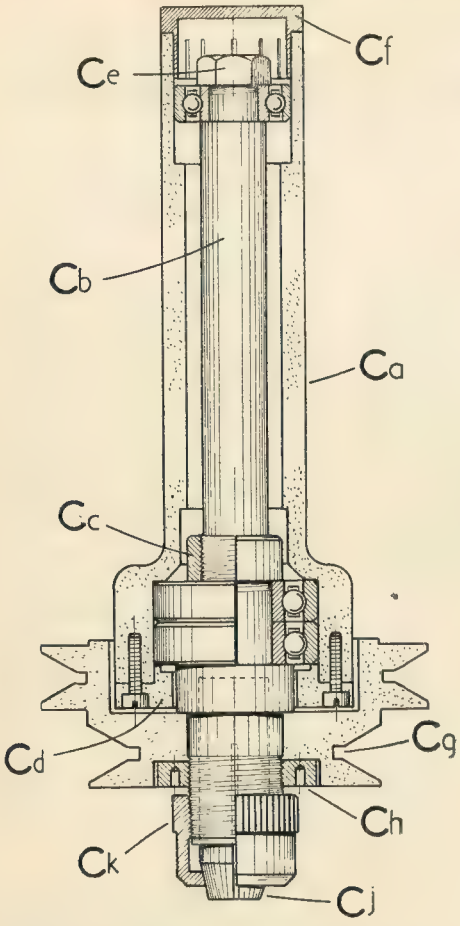


Fig. 21. The cutter head shown in part-section. Reference letters as in previous figures

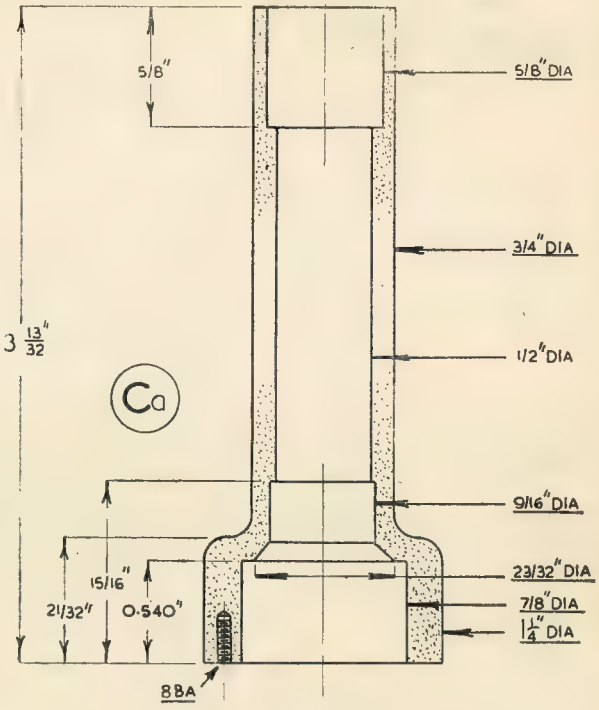


Fig. 22. The body of the cutter head

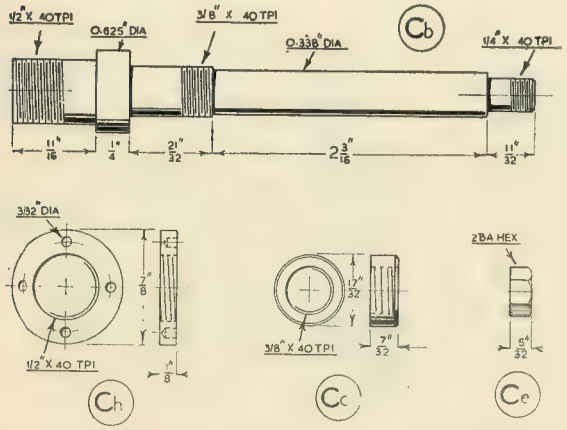


Fig. 23. The cutter spindle and locking rings

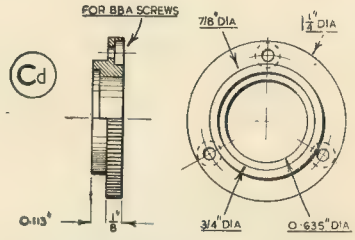


Fig. 24. The lower bearing clamp-collar

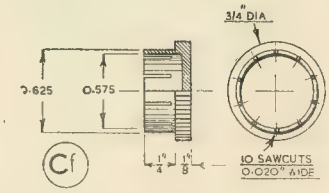


Fig. 25. The dust cap

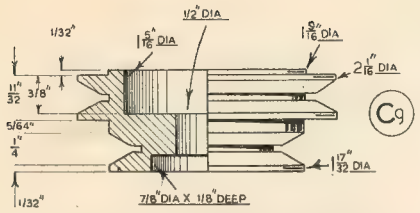


Fig. 26. The spindle driving pulley

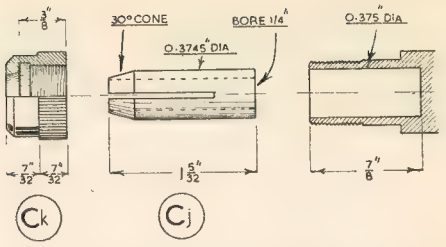


Fig. 27. The collet chuck parts

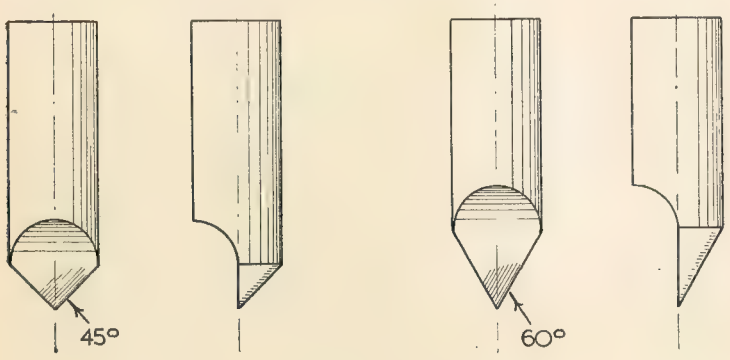


Fig. 28. The D-bit type of engraving cutter

spindle is set to run truly in the four-jaw chuck, and the setting must be adjusted until the test indicator shows that there is no run-out. In addition, the work must be mounted with as little overhang as possible.

Next, the end of the spindle is drilled and afterwards finished to size with a small boring tool, in order to make sure that the bore is both parallel and concentric.

The collet *Cj*, is made a close sliding-fit in the spindle bore and, to ensure accuracy, it is machined at a single setting and the bore finished with a small boring tool. Difficulty is sometimes found in slitting these small collets, but an easy way is, we find, to carry out this operation while the work is still held in the chuck and before it is parted off. The milling attachment is mounted vertically on the lathe and a circular slitting saw is attached to the milling spindle and set at lathe centre height. The slots are indexed either by means of the mandrel dividing attachment or from a change wheel mounted on the tail of the mandrel. The closing collar *Ck*, should, again, be knurled, threaded, and the nose cone formed at a single setting in the chuck. The thread is best screwcut, and when this is done, a recess should be machined at the end of the thread to provide a run-out for the screw-cutting tool. The collar is then protected by a layer of thin card to prevent damage by the chuck jaws.

Where work of this kind is gripped in the chuck, the knurling should be protected by a layer of thin card to prevent damage by the chuck jaws.

Engraving Tools

The tools commonly used in engraving machines are in the form of D-bits, as illustrated in Fig. 28. It is important that the flat surface of the "D" is made to lie exactly on the axial centre-line of the cutter; otherwise, the extreme point will travel on a circular path and will inscribe a small circle on the work instead of a conical depression. As pointed out recently in the columns of this journal, the cutting point is usually made in the form of a regular half-cone and no back-off is given behind the cutting edge. Clearly, these standard cutters have only a small margin of machining efficiency and, as soon as there is slight wear at the cutting edge, the tool will tend to rub and cutting will be slow.

However, we recently had the opportunity of talking to the operator of an engraving machine while he was at work and, as presumably he makes his living in this way, his experience and advice should carry some weight, for he has, no doubt, found out what kind of tools give the best and quickest results. The cutters he was using were ground free-hand with a marked back-off at the cutting edge. After we have made up some cutters of this kind and given them a thorough trial, we will describe their performance in some notes on operating the present machine.

(To be continued)

★ *Our Cover Pictures*

Readers of *THE MODEL ENGINEER* are invited to submit for consideration photographs which may be suitable for cover pictures. The subject must be within the scope of this journal and reference to the covers of this year's issues of the "M.E." will give an indication of the type of photograph preferred. If accepted for publication, a reproduction fee of two guineas will be paid.

Prints should be addressed to . . .

The Managing Editor
THE MODEL ENGINEER
19-20 Noel Street
London, W.1

L.B.S.C.'s Titfield Thunderbolt

IN 3½ AND 5 INCH GAUGES

BEFORE proceeding with the description of how to build the smokeboxes for the two *Tits*, I just want to address a few honest-to-goodness straight-to-the-point remarks to our friends who are building them, and to any other readers who may be interested. The reason is just this—that anybody building a locomotive of the type I am describing, is faced with two choices. He must either build the engine exactly to my specification, or build a reduced copy, or in other words, the dearly-loved "scale model," of the full-sized job. Now if he wants a locomotive that *is* a locomotive, which will do a real job of work in the same manner as, or proportionately better than its full-sized relation, he will take the first course; but—and this is the rub—in doing that, he must be prepared to discard full-sized details of construction, and build the engine to suit the gauge, and the rules of nature. If he wants to make an exact copy of the full-sized job, then he must be prepared to produce a useless ornament; I use the word "useless" in the sense that the engine would not run and pull a load on a small railway. It might look pretty in a glass case in the museum, but I'm open to bet that 99 per cent. of the lads of the villages would rather see it doing the job for which all full-sized locomotives are intended.

Letters have appeared in the correspondence columns, and I have received some direct, in which the writers find fault with the details of the engines, because they vary from those on the full-sized engine. To save further unnecessary correspondence I would like to tell all concerned, here and now, that I am doing my utmost to keep the appearance of the little *Tit* in accordance with her not-so-big sister; and whatever variations are made are solely in the interests of working efficiency. Now the smokebox described below varies quite a lot from the smokebox of the full-sized engine in the method of construction, although it *looks* all right. I don't have to remind old followers of these notes that if a smokebox isn't absolutely air-tight, the engine won't steam for toffee-apples. With the tiny boiler specified, which is of correct proportionate size, builders who want their locomotives to perform in the manner usually expected among engines described in these notes, can't afford to risk any method of construction which might result in air-leaks; and as it would be a very difficult job indeed, to make two thin sheetmetal "cupboard" doors which would close airtight, and *remain* airtight when they became hot and expanded, I am specifying a one-piece pull-out smokebox front, with a couple of dummy doors on it for the sake of pleasing Inspector Meticulous. The flange of this, fits into a circular smokebox shell, inside the old-fashioned smokebox wrapper, and this does away with the need for making the wrapper itself with air-tight joints, which would be another tedious and exasperating job. I hope everybody will be satisfied !

Construction

The smokebox barrel, or shell, for the 5-in. gauge engine is a piece of 4⅜-in. × 16-gauge brass tube (common quality will do quite well) squared off in the la he a both ends, to a length of 2½ in. The smaller one needs a piece of similar tube, 3⅛ in. diameter × 16-gauge, 1¾ in. long. Halfway along, cut the chimney holes, ⅞ in. diameter in the larger one, ⅝ in. in the smaller. Drill a pilot hole first, enlarge with a drill a little below finished size, and finish with a reamer; or else drill a circle of small holes around the marked place, break out the piece, and finish with a half-round file. Exactly opposite, drill the blastpipe holes to sizes shown in the illustration.

As the smokeboxes are larger than the boiler barrels, distance-rings must be fitted to fill the gaps. These may be cut from tube of requisite diameter, bent up from sheet, or may be castings. If the latter, chuck in three-jaw, and bore to fit tightly over the boiler barrel; round off one edge as shown. Reverse in chuck, holding the ring on the outside jaws, and turn the outside to fit in the smokebox barrel. Press it in, until the radiused part is just showing. Four $\frac{1}{16}$-in. or 10-B.A. screws may be put through ring and smokebox, to prevent the ring slipping when pressing the smokebox on to the boiler. Rings made from tube or sheet, are fitted in the same way. There is no need to silver-solder the joint in a ring bent from sheet material. The smokebox shell can then be pushed on to the boiler barrel, with a smear of plumbers' jointing to make the joint airtight. Be sure that the chimney hole is exactly at the top.

The smokebox wrapper sheet is only a strip of 16- or 22-gauge sheet steel, $\frac{1}{16}$ in. wider than the length of the smokebox. Bend it to an arch shape; line up the hole in it with the hole in the smokebox barrel, which can easily be done by putting a wood or metal plug in, cut the sides to full length, and attach them to the smokebox barrel by three or four countersunk screws at each side, filing the heads flush. Bits of screwed wire would do; just hold the wrapper and shell in close contact, drill No. 48 holes through both, tap 3/32 in. or 7 B.A., screw in the bits of wire, and file flush—cheaper than screws, ye ken ! The sides of the wrapper can be cut to exact length after fixing.

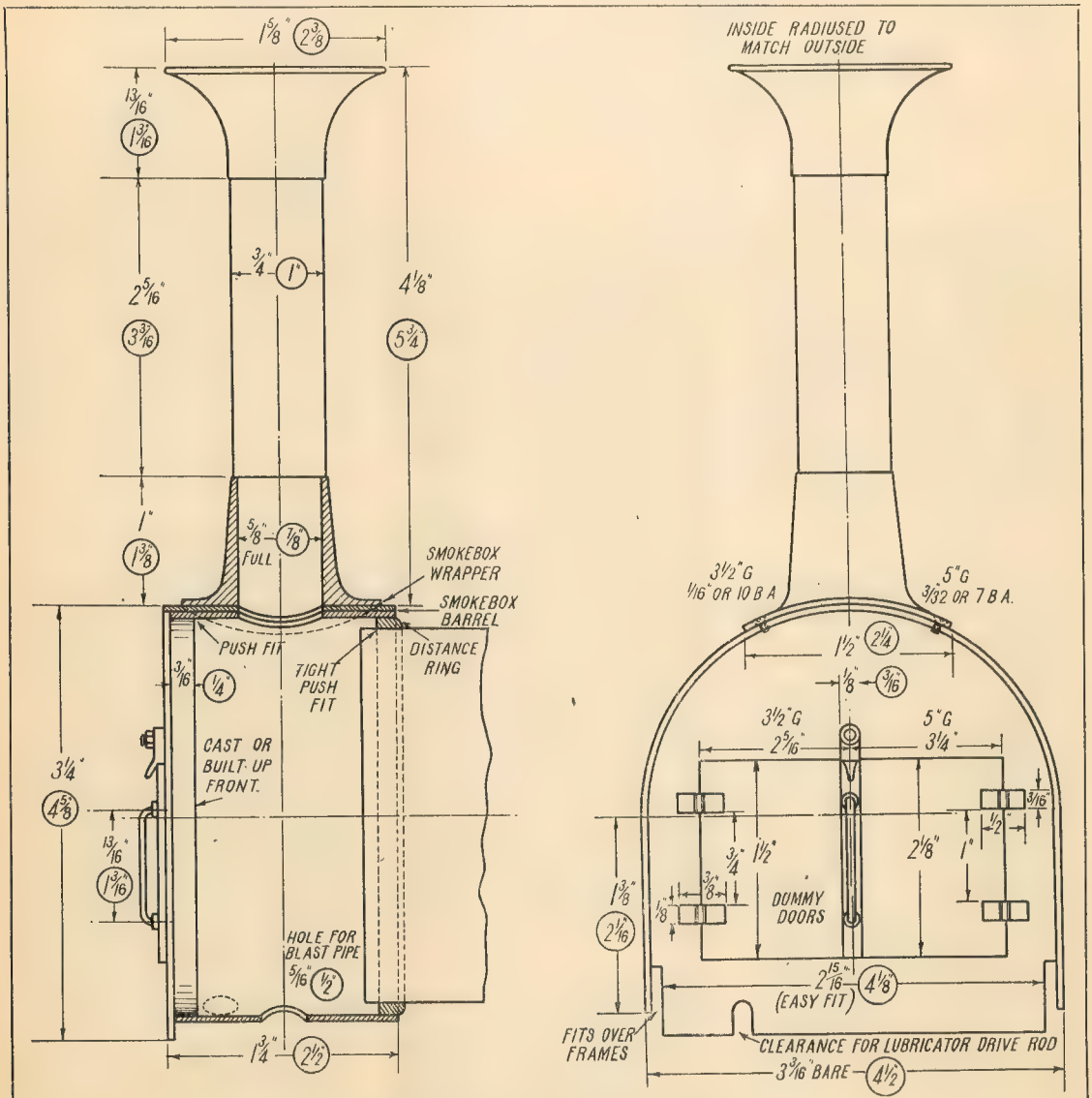
Smokebox Front

The smokebox front can be either a casting, or built up. If our enterprising approved advertisers supply castings, they should have the dummy doors and hinges cast on, which will save time and labour. Anything that saves work appeals to your humble servant; I guess that I must have been born tired ! If they are cast on, however, it cattles up any idea of a chucking spigot being provided for holding the casting when turning the flange that fits inside the smokebox shell; so the casting would have to be chucked in the four-jaw with the flange running as truly as possible. It could then be turned with a knife tool, but don't have the lathe

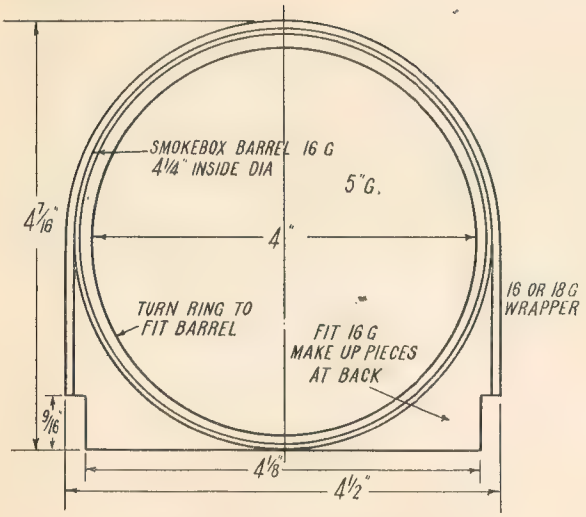
running too fast on these big diameters. We hear a lot about turning big diameters at high speed with carbide-tungsten tools, and so on, but even if you are one of those lucky folk who own carbide-tungsten tools, there are one or two other little things to take into consideration, as any really experienced turner could tell you. "Slow and sure" is a good motto, in more ways than one! The metal around the flange can be faced off at the same time.

If the dummy doors are cast on, the front face will have to be finished by hand. If they aren't cast on, reverse the casting, and rechuck it in the three-jaw by the flange; then face off the whole of the front. The dummy doors can then be cut from sheet steel, or brass, about 18-gauge, to the sizes given in the illustration. Only one piece is needed for the two doors, and it can be riveted by one countersunk rivet, about 3/32 in. or 7 B.A., at each corner. The centre strip can be held by a $\frac{1}{16}$-in. rivet at top and bottom. The handle can be bent up from a bit of $\frac{1}{16}$-in. or 3/32-in. wire, according to size of engine, and pushed through two holes drilled right through strip, dummy doors and front plate, and riveted over on the inside. Put a weeny washer at top and bottom of the handle. The locking catch can be filed up from a scrap of brass, or steel, and attached to the front by a hexagon-headed screw, or a stud and nut. The hinges can be cut from thin sheet brass or steel and riveted in place by bits of domestic pins.

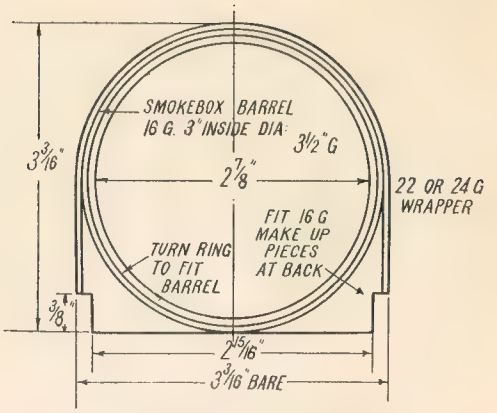
The complete front should be



Section and front view of the smokebox



Back of 5-in. gauge smokebox



Back of 3½-in. gauge smokebox

quite easy to insert when the boiler is erected, if the ratchet lever of the mechanical lubricator is placed as far forward as it will go, and the front dropped down so that the lower part goes between the inside frames. It should fit easily between them; the flange should then push easily into the front of the smokebox barrel, but not slack enough to come out when running, naturally. Also it needs to fit airtight. The outer edge of the front should fit nicely in the wrapper; this is merely a question of careful filing.

Built-up Front

Should a casting not be available for any reason, the front can easily be built up. The front plate should be not less than 16-gauge, either hard brass or steel, and may be thicker if desired. Cut it a little larger than finished size, for the kick-off. The flange can be made from a piece of tube, or a piece of strip metal bent into a ring, same as the distance ring at the back. Mark out the location of the flange on the back of the front (says Pat), put it in your brazing pan with the ring or flange carefully set in position, and silver-solder it. If anybody tries to do that little job with an oxy-acetylene blowpipe, I can assure them that they will learn quite a lot about expansion and contraction by the time they are through ! The whole lot must be heated up very carefully with a big diffused flame to prevent the thin sheet metal front going all sorts of funny shapes; but care will do the trick. After pickling and washing off, the front can be filed to fit the wrapper. The dummy doors, hinges and handle can then be fitted exactly as described above. In either a cast or built-up front, it will be necessary to file a clearance for the driving rod of the mechanical lubricator; and the exact position of this, should be measured from the actual job. This need not be done until the boiler is erected, and we have to make the fittings and the grate and ashpan before that job is tackled.

Smokebox Back Plate

The space between the smokebox shell and the wrapper sheet at the back of the smokebox will need filling in; and this can be done by cutting out a piece of 16-gauge steel or brass to the shape shown in the illustrations of the back of the smokebox, and fitting at each side. They can be attached to the wrapper by short bits of angle, riveted on, or alternatively the straight side of the piece can be left ¼ in. wide, bent at right-angles, and riveted to the inside of the wrapper. There is no need to attach them to the smokebox barrel as long as they fit fairly closely. They can't part company with the barrel, as the bottom part of each goes down between the side frames when the boiler and smokebox are erected.

Chimney

When my fair lady first saw the outline drawing of the *Titfield Thunderbolt* she said that the sweep would need an extra bob to poke his brushes through the chimney. She reckons my *Tugboat Annie* looks horrible, with only a little ring about as wide as a wedding-ring, showing above the smokebox. For my own part, I like them about medium, like *Grosvenor* and *Jeanie Deans*, but we can't have all that we would wish for in this benighted world, more's the pity ! Castings will be available for both sizes of chimney for the larger and smaller *Tits*, and turning them is just a plain straightforward job. If anybody has a three-jaw with a hole through it, big enough to admit 1½ in. diameter for the smaller size, or 2¼ in. for the larger size, the casting can be held in it for boring the barrel and turning the inside of the bell top. The casting would be put well through the chuck, so that the jaws would close down on the barrel.

Those with the usual small chucks can proceed as follows. Make up a ragtime wooden steady, same as I described for turning the ends of the tubes, but cut it right across the hole with a thin saw and fit a couple of woodscrews to hold the bits together, like an eccentric strap. Of course, if you've got a regular steady, like that which came with the Myford " Supersonic," no need to bother about rigging one up. The hole through the improvised one should be the same size as the outside of the chimney barrel. If the base of the chimney is gripped in the three-jaw, and the steady put on the barrel as close to the bell as possible, the chimney can be bored out to the given size, just like boring a cylinder. The inside of the bell can be cleaned out with a hand-tool (a graver would do it) supported by either a regular T-rest, or on a bit of square bar, held in the slide-rest tool-holder.

The chimney can then be mounted on a mandrel between centres, and the outside turned to the sizes and shape shown in the illustrations. A

(*Continued on page* 474)

A LETTER BALANCE IN BRASS

By A. D. Stubbs

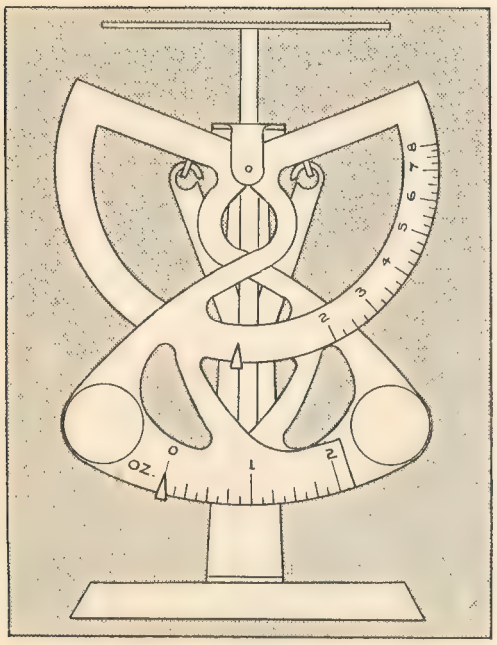


Fig. 1

THIS has been one of the most useful household gadgets which I have ever made. Previously, we had a pair of scales, with loose weights, and inevitably the smaller weights got lost, whereas with my counterbalance weigher we have had no trouble at all, excepting one, due to bad design, of which more later.

The thing weighs dead accurately up to eight ounces, is all brass, so, therefore, non-rusting, and it has no loose parts. As I look up at mine now, the only thing I can say against it is that it ought to be dismantled, re-polished and lacquered, because it is almost impossible to keep it polished in its assembled condition, as you will appreciate from its general appearance, in Fig. 1.

The base, Fig. 2, was cut from 16-gauge sheet brass, the same material being utilised throughout, excepting for the platform rod. My sketch shows the cutting dimensions in half the view, the material being bent down on the rectangular dotted lines to form the shape in other half view. The standard, Fig. 3, is setscrewed to the base. Originally, I intended to fill the underside of the base with lead, but the completed balance stands quite satisfactorily without, although one of the nuts did come loose once, so I soldered them on permanently.

My standard was a work of art, necessitating quite a number of hours work, much of which went into the final polishing, because I foolishly left the sheet "commercial" finish until I had completed it. Were I making another, I should polish the sheet before bending it from the flat. The only point to watch here is to ensure that the three pairs of pivot holes are in line. All my pivot pins are $\frac{1}{16}$ in. diameter brass wire, sweated into position after assembly, but I have not dimensioned the holes, as any convenient hard material can be utilised.

Two oscillating brackets, Fig. 4, are required. I have lettered the ends in the sketch, to indicate that *B* and *C* of the respective brackets sit astride *B* and *C* on the standard. The *D* and *E* ends are pivoted on the platform rod, Fig. 5.

In the upper end of the rod a hole is drilled and tapped, for a countersunk screw, the latter securely fixing the platform in position. This screw is probably the weakest part of my balance, so a spot of solder was run round the junction of the platform and rod. The latter, by the way, is only $\frac{3}{16}$ in. diameter. My platform is 3 in. diameter.

Now I come to my piece of faulty designing, which is in the connecting-rods, Fig. 6, two of which are wanted. Here again I have lettered the ends for ease in assembly. Originally, my hole in the *G* end

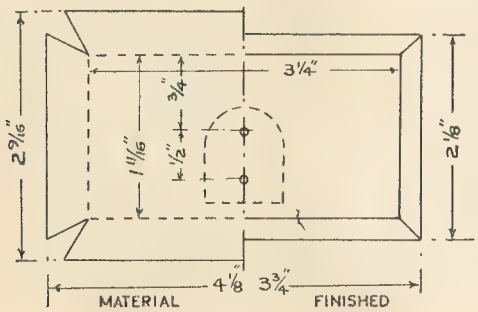


Fig. 2

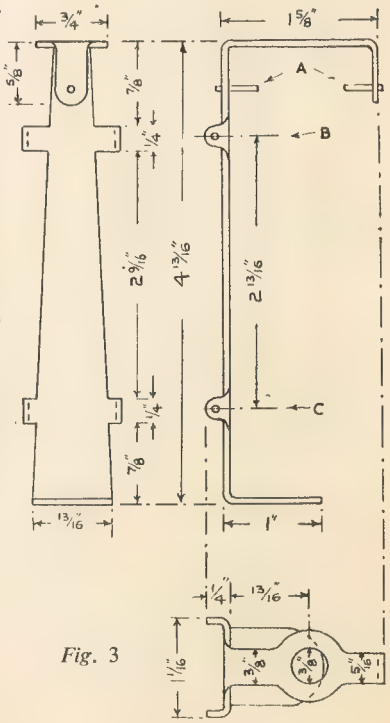


Fig. 3

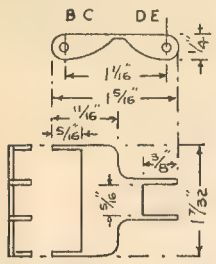


Fig. 4

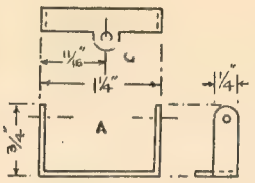


Fig. 7

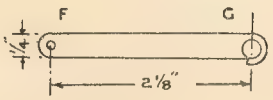


Fig. 5.

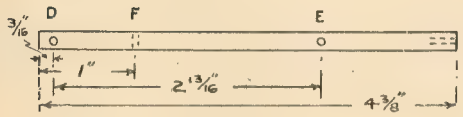


Fig. 6

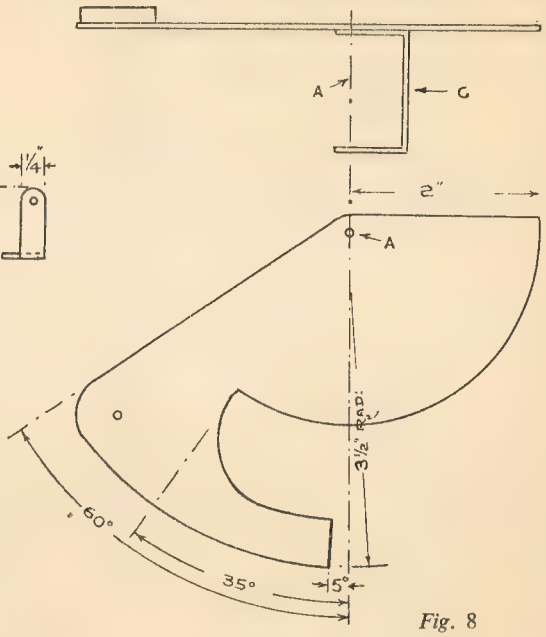


Fig. 8

was drilled $\frac{1}{8}$ in. on the centre-line, and I overlooked that the cranks entering-piece is rectangular in section, necessitating either a larger hole or an oval one. To get over this little mistake, I pulled out the semi-circular ring of metal, and filed out the hole. As shown, the connecting-rod will be satisfactory. Incidentally, when the balance is fully depressed, which is beyond its scaled range, and at a weight probably equal to ten ounces, the opened-out ends of the connecting-rods contact the brackets, so forming a stop. The connecting-rods would look better were they not cut parallel, but increased to $\frac{5}{16}$ in. width at the *G* end.

My two cranks, Fig. 7, are sweated on to the quadrants, as shown in Fig. 8. These present no problems, but they are handed, so one requires to have the arms bent 180 deg. from those shown in the plan view. It is the right-hand arm of each crank which is sweated to the quadrant. The quadrants themselves offer quite an opening for individual expression in design. Fig. 1 shows my pattern, whilst Fig. 8 indicates what is probably the most simple form. Unfortunately, I cannot give you the weight of the circular counter-weight on each quadrant. Mine are $\frac{3}{16}$ in. diameter brass, 5/32 in. thick, and were cut from the scrap end of piece of marine propeller shaft.

However, their weight and size are really immaterial, because it is essential to mark off the weight scales on the quadrants after loading the balance progressively. The two indicators of the quadrants, shown in Fig. 1, are strips of brass, $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in., one end being filed to a point, the whole bent to a U-shape, and the other end soldered to the reverse of each quadrant.

When you are ready to mark off the weight calibrations, assemble the balance temporarily, and load it with eight ounces. If the pointer then reaches the approximate position of my figure 8 you can go ahead, otherwise the counterweights can be either filed down, or duplicated, preferably on the back of each quadrant. The Fig. 8 quadrant design incorporates far more metal than does mine, and the bulk of this detracts from the counterbalance, excepting at the lower scale range, so the plain design will give a wider scale reading from zero to at least one ounce.

"L.B.S.C.'s" TITFIELD THUNDERBOLT

(*Continued from page* 472)

bit of hard wood would do quite well for a mandrel. Alternatively, a bit of hard wood could be driven into each end. One end could be held in the three-jaw, and the other end supported by the tailstock centre, the hole for same being made by a centre-drill. Again, bits of rod metal could be used for the end plugs; it doesn't matter which way you go from Tottenham-Court-Road-Street to Timbuctoo, as long as you get there! An ordinary round-nose tool will settle the parallel part of the chimney; set the topslide over approximately 5 deg. for the tapered part of the base. The outside of the bell can be finished with a wide-radius round-nosed hand tool, supported as above. The saddle part must be finished with a file; it cannot be turned, owing to the shape of the radii, but this is merely a little exercise in hand craftsmanship. Use a fine-cut half-round file, and finish with emerycloth or similar abrasive. Careful hand filing will be sufficient to bed the casting to the smokebox, and it can be finished by putting a piece of emerycloth between chimney base and smokebox, and rubbing the base on it. Don't mount the chimney on the smokebox until the boiler is erected; this will make certain that it "stands erect." Next stage, fittings.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Fluctuation of Alternator Voltage

I am using a 120-volt 60-cycle alternator, driven by a single-cylinder petrol engine, for house lighting. This is reasonably satisfactory when driving the workshop motor, but there is an irritating variation of voltage on the lighting circuit. Can you advise me how to remedy this?

E.A.G. (Dorchester)

We think that this could largely be removed, or at least reduced, by using a fairly heavy flywheel between the engine and the generator. If the engine is direct coupled, the flywheel should be on the coupling end of the shaft, not on the far side, as this might possibly cause crankshaft trouble.

We take it from your description that the fluctuation is definitely in tune with the period of the engine firing strokes. If, however, you refer to variation of voltage when the load on the generator is altered, this can only be cured by an improvement in the engine governing system. If no governor is fitted, either a centrifugal governor on the engine, or a voltage controlling governor in the electrical circuit, would be required.

35 mm. Films

I am very interested in home cinematograph projectors, and would be much obliged if you would inform me where I could obtain standard size 35 mm. films. I was able to obtain these before the war, but have found some difficulty in obtaining them in recent years.

S.A. (Liverpool, 3).

We take it that you refer to continuous lengths of film for cinematograph projection, but if so, we regret that we do not know of anyone who can supply these.

The fact is that since the substandard films of 16, 9.5 and 8 mm. sizes have been available, the 35 mm. size has been used only for projection in cinema theatres, and has not been available to the general public at all.

One reason why the supply of these films is not encouraged is because they are highly inflammable, and several fires have occurred when they have been used in places without proper fire precautions.

Home Foundry Work

I wish to make my own castings, using scrap aluminium from motor-car crank-cases, etc. Can this be broken up and melted in an old iron cooking pot? If not, perhaps you could advise me of a firm who could supply the necessary crucibles, also suitable sand for moulds, etc. Any further advice on this subject would also be welcome.

E.B. (Saffron Walden).

Several articles on this subject have been published in THE MODEL ENGINEER, including those by B. Terry Aspin and A. L. Headech. Those by Mr. Headech appeared in the May 25th and June 8th and 15th, 1950 issues and that by Mr. Aspin in the March 5th, 1953 issue.

It is quite practicable to melt aluminium and its alloys in an iron pot, but there is some risk of the aluminium becoming contaminated with traces of iron, which is not generally desirable. A clay or plumbago crucible is more suitable, and such crucibles can be obtained at fairly low prices. Sand and other necessary supplies for foundry work can be obtained from Foundry Suppliers Ltd., 25a, Cockspur Street, London, S.W.1.

Synchronous Electric Clock

I am proposing to use a synchronous motor for driving a replica period clock, and should be glad of your advice on the following points:—

(1) *The striking mechanism is to be driven by a separate synchronous motor which is cut in and out by a mercury switch. I find that this causes radio interference, and should like to know how it can be suppressed.*

(2) *It is proposed to operate a bell hammer by a solenoid to work on mains voltage, and I should be glad of advice on how to design a suitable solenoid to raise about 3 oz.*

(3) *What is a suitable material for the contacts in the striking mechanism, which will have to carry mains voltage? There are 36 of these contacts, and it is hoped that the material will not be too expensive. Also, please inform me where suitable contacts can be obtained.*

E.L.L. (Orpington).

(1) Interference caused by the action of a switch is sometimes difficult to deal with effectively, but one possible method would be to enclose the entire switch mechanism in an earthed metal case. A further precaution would be to connect a condenser across the switch contacts, but the exact capacity would have to be found by trial, as it would depend really on the inductance of the circuit being controlled. The condenser must be of a type which is capable of withstanding at least 50 per cent. above the supply voltage continuously.

(2) The design of a solenoid to operate on a.c. mains is a somewhat difficult problem, as the varying current impulses are apt to cause a tendency for the movable core or armature to chatter. We cannot give you a suitable specification for a aolenoid in these circumstances, but we suggest that as a basis for trial, about 5,000 turns of No. 44 gauge wire on a former capable of taking ½-in. core might be tried. The core or armature will have to be laminated to avoid heating by eddy currents.

(3) The most suitable metal for contacts to withstand mains voltage would be tungsten, and the necessary material, or either rivets or screws tipped with tungsten, can be obtained from F. Claudet Ltd., 23, Gloucester Way, London, E.C.1. These contacts are not unduly expensive.

Super Relm Lathe

I have recently obtained an incomplete Super Relm Lathe. The headstock, however, is missing, and I should be glad if you could give me any information concerning this lathe, also by whom it was manufactured, and where I am likely to be able to obtain the missing parts.

J.H.G. (Castle Bromwich).

The Super Relm and Relmac lathes have been out of production now for many years. They were previously manufactured by The Cheltenham Works Ltd., Acre Lane, Brixton, London, S.W.9. We have no exact details at present available on these lathes, and we think it extremely unlikely that anyone would be able to supply spares for them.

From Start — to Finish

A DETAILED DESCRIPTION OF THE BUILDING OF A " M.E." EXHIBITION PRIZE-WINNING LOCOMOTIVE

By R. K. Boardman

BECOMING rather impatient at this stage, I decided to purchase a ready-made injector. Being in close contact with Messrs. Kennion Bros. for my various wants, I decided to purchase one of their Linden injectors, but could not make up my mind as to which size. The small one seemed too small and the large one too big. On the advice of Mr. Chas., I played for safety and ordered one of the large ones. I have always been rather sceptical about small injectors. I have had a limited experience with full-size injectors on steam rollers and sterilising boilers, and have found them touchy on occasions. I therefore thought I would give my large Linden every encouragement. It was noticed that the steam supply, delivery, and water feed unions were for ¼-in. pipe, whereas " L.B.S.C." had specified 5/32 in. and $\frac{3}{16}$ in. for the connections to his little injector. Arranging the larger water feed pipe was quite simple, but in order to keep the delivery pipe as short as possible and out of view, this was taken to the backhead via ¼-in. pipe and suitably larger ball and orifices in the clack. The hand-pump delivery was then taken to the front left-hand boiler clack which was kept at $\frac{3}{16}$ in. diameter as prescribed. The steam supply was the next problem, as this necessitated modifying the valve design as shown (Fig. 5). In this way, it was no larger externally, but had considerably larger orifices. In order to avoid clumsy unions on the backhead the ¼-in. supply pipe was screwed direct into the valve, being bent afterwards and the injector union fitted.

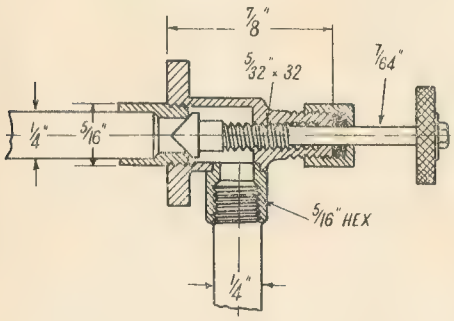


Fig. 5. Modified injector steam valve

The results of this arrangement have been well worth the trouble; the injector has never failed to start except for obvious reasons (no water) and if required, will inject continuously approximately 1¾ pints of water into the boiler in under a minute. It will work effectively down to a pressure of 40 lb. per sq. in., but has not been tried below this pressure. I have not had any experience with the smaller Linden injector, but I am of the opinion that if results are comparable, one of the smaller injectors would have been sufficient. However, too much is better than not enough, and may save a lot of worries at some future date.

The $\frac{3}{8}$ in. diameter feed pump is more than capable of maintaining a full boiler whilst the engine is running. Under normal conditions, this can be relied upon, but having regard to learner-drivers who find there is a lot to think about, it is nice to be able to top up the boiler quickly when the water is observed to be level with the " bottom nut."

Another small deviation which I made from the original instructions was in the by-pass valve. Possibly my army experience as an inspector, has brought me almost to a blood-relationship with that well-known character " meticulous." Be that as it may, I do like to have fittings with handles, rigidly mounted. I have visions of turning a valve that is stuck on its seat, and winding the connecting pipes round it. My modifications to prevent such an occurrence consisted in lengthening the body and fitting it direct to the drag-beam, in this way it can also be utilised to hold down the back end of the running-board (Fig. 6).

Having now a chassis and boiler that would work, a length of track seemed of next importance. My track in the orchard had been mapped out during the summer months and excavation had begun. As there was about 6 ft. fall in the length of orchard I intended to use, it was decided to excavate the top half to form a cutting, the soil being deposited to form an enbankment for the lower half. The track was to be oblong totalling approximately 150 yd., deviating slightly here and there to miss either a shed or tree. On top of the levelled soil a strip of concrete was laid about 9 in. wide by 4 in. deep. After much thought, regarding the design of the track, I came to the conclusion that the rails should not be less than $\frac{3}{16}$ in. thick in order to give reasonable grip for the driving wheels. A small quantity of $\frac{3}{16}$ in. by $\frac{3}{4}$ in. bright mild-steel was already in my possession, and the design was arranged to incorporate this material.

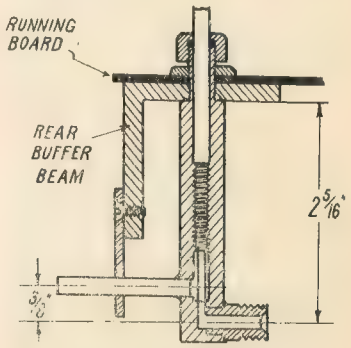


Fig. 6. Modified by-pass valve

(*Continued from page 447, April 22, 1954.*)

Various methods of construction were considered, but I felt that much time and trouble would be saved if the chairs and sleepers were cast in one piece. The slots for the rails were gang-milled and $\frac{3}{16}$-in. Allen grub-screws fitted to the chairs to allow slight adjustment for height, and to maintain even spacing and even radii on curves. The sleepers are cast in aluminium alloy and are spaced at approximately 9 in. centres. About every fifth sleeper is Rawlplugged to the concrete, but these are not set-screwed to the rails. At the beginning and end of each length of rail, approximately 11 ft., a fixed sleeper is fitted having the set-screw holes offset, so that one end only is fixed, the other end being free to slide in the chair slot. About $\frac{1}{16}$ in. is left between the ends of the rails for expansion. Each sleeper is laid on a strip of roofing felt and small pieces are inserted under the ends to give the correct camber and take up any irregularities in the surface of the concrete. I am aware that my method of gang-milling the slots in the rails means that the gauge cannot be increased on curves as in full size. My minimum radius, however, is 18 yd., and I do not consider the slight difference worth worrying about, especially with a 4-4-0 wheel arrangement such as the *Maid*.

The sleepers are cast in 14-in. boxes six at a time. I made six patterns which were mounted on a plate (wooden), the underside being recessed to coincide with the patterns; in this way, the castings are recessed underneath to avoid wastage of material (see Fig. 7). To melt the aluminium, I have converted an old Tortoise stove; instead of the one ashdoor at the bottom in the front, I have fitted two doors, one each side. The total height has been shortened by about 6 in. and a large circular hole turned out of the top casting, so that the crucible can be removed and replaced with suitable tongs. The addition of the extra ash or draught door has overcome the usual trouble with these stoves, that of burning away the firebricks and subsequently the stove casing around the door, due to heat concentration because of the localised draught. The height was cut down so as to make the stove more economical, a larger fire underneath the crucible would be wasted, there is now plenty of room for combustion of the coke under and around the crucible. About 20 ft. of cast-iron chimney pipe gives sufficient natural draught to enable a cast to be made from cold in about one hour, and can easily keep pace with a moulding and casting rate of one per half-hour (six sleepers). The machining of the sleepers takes approximately five minutes each. This includes cutting off runners, filing up, gang-milling slots, and drilling and tapping $\frac{5}{16}$-in. holes for set-screws. All these operations are undertaken on miniature mass-production lines, about 36 at a time; in this way no single operation gets too monotonous.

With the commencement of the track, it seemed I should soon have an engine capable of running, a length of track to run on, but no truck to sit on. I dislike temporary contraptions, as I find they are apt to become too permanent; so I started thinking about a good truck, easy and quick to build, combining the essential qualities of easy running, stability and keeping on the rails. Having referred to several articles and advertisements on the subject, I preferred a design marketed by Messrs. A. J. Reeves of Birmingham, from whom the castings were obtainable. The castings were in gunmetal with cast-iron wheels, but in view of the then expected increase in the price of gunmetal, I was prompted to buy a set without further delay. I notice from subsequent advertisements that these castings are now available in cast-iron. Incidentally, I see no reason why they should not be produced in aluminium alloy. If this would not produce a saving in initial cost, it would at least save much time in machining, especially as the majority of this is hand filing. The wheels would, of course, remain in cast-iron, as would the brake-blocks. The only difficulty I had in making up these bogies was the machining of the slots in the centre-bearing casting, which are provided for the downward side thrust rollers. I could think of no way of machining

Two views of Mr. Boardman's 5-in. gauge track in an orchard

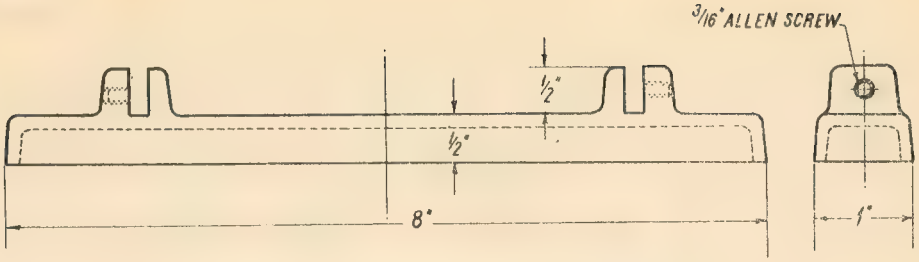


Fig. 7. Details of the cast-aluminium sleepers

the bottom of this slot, apart from chiselling and scraping, but this proved difficult and inadequate. The rollers jammed sideways, or always seemed to be at one end or the other, thus defeating their object. In order to overcome this difficulty, this slot was modified (Fig. 8). New rollers were turned from silver-steel, but left an extra $\frac{3}{16}$ in. long both ends, these ends being turned down to $\frac{3}{16}$ in. diameter. Suitable slots were filed in the castings to accommodate the ends, and the slots were deepened to allow clearance. Although the perfect rolling action was not maintained, at least a moderately efficient bearing was provided that would not jam, and was simple to machine and fit.

Recent experiments with passenger trucks have shown that it is quite feasible on 5-in. gauge to raise the seats by about 6 in. and set the footrests slightly above rail level. All my trucks will be made to this pattern, so that I can work a system of points without the inconvenience of lifting sections of the track to avoid hanging footrests.

After three and a half years, I now had the beginning of my own railway. During the summer of 1952, I completed the final trials, and had many hours of good steaming. The track is still uncompleted, but I have about 100 yd. already laid. During the winter months, the task of finishing the superstructure and final details were tackled with renewed vigour. The cab roof was the first problem encountered, as I do not approve of the usual method of leaving out the centre portion of the roof for driving. Having thought out a complete sliding roof, I finally preferred to make it lift up at the back and tilt forward, the front end being spring-loaded; in this way, it is easily tilted for driving, the joint when in the normal position being hidden by the rain-strip. To round off the trimmings, working steam brakes and sanding gear were fitted, a photograph of the original being constantly referred to for exact positioning of handles, handrails, etc.

Painting

So far, so good, and now for the painting. I had never done any spray-painting and thought it was time I learnt. From various sources of information it was obvious that stove enamelling was the best and the more correct way of finishing a locomotive, so this method was adopted. One of our regular paint advertisers was contacted and lists obtained. Sufficient quantities of the recommended materials were ordered, and I then started building an " M.E." spray gun. The gun was completed in record time, but results were rather disappointing. I came to the conclusion that perhaps I was asking too much to expect to learn to spray on a home-made spray gun. Lists were obtained from Messrs. Aerograph, and I duly purchased one of their " M.P." spray guns. To my surprise, this was no better than the gun I had just made ! Subsequent correspondence with the makers revealed that the gun was quite unsuitable for stoving enamel which is applied very much thicker than normal paint. They recommended their " M.P.S." gun with a No. 3 size jet, which, when put into action immediately on arrival, gave different results altogether. After a few trials for best pressure, etc., the painting became comparatively simple. The stoving was all carried out in the domestic " Esse Minor " cooker, with the exception of the running-boards, which were too long to be accommodated. For the latter, I had to make up a special long oven which was heated by four Calor gas burners.

The stages in painting were as follows :—

(1) Spray on undercoat (Redox Universal) and allow to dry (1½ hr. minimum).

(2) Stove at approx. 250 deg. F. for 1½-2 hr. Rub down.

(3) Spray final colour (stove enamel) and allow to dry (12-24 hr.).

(4) Stove at approx. 250 deg. F. for 1½-2 hr.

No further rubbing down or polishing is necessary. If any parts are particularly rough, it may be advisable to give two or more coats of undercoating, each being stoved and rubbed down before applying the finishing coat.

Lettering was just a matter of finding the right brush and the right

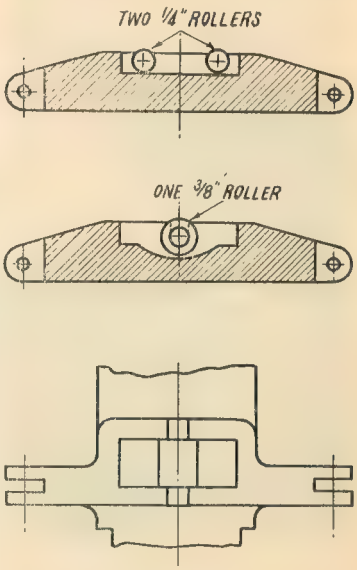


Fig. 8. Modifications to passenger truck bogies

amount of patience. The correct shape of letters and numbers were copied from the photograph, with the aid of a magnifying glass. It was at this stage, I decided to number the locomotive No. 759. According to the author the *Maid's* big sister was No. 756, but as most of the detail had been taken from a photograph of 759 I thought it should rightly carry that number.

For lining out, various methods were tried, but it was found that by

far the simplest method was by using a No. 2 Uno pen with the centre wire removed. If the paint is mixed to the right consistency, it will just flow evenly. Curves were made either by using a draughtsman's pen-compass or by running the Uno pen round a suitably-sized ring.

By this time, the locomotive was beginning to look rather better than I had ever imagined, and it was this reason, prompted by remarks from a few friends, which encouraged me to enter it for the 1953 " M.E." Exhibition, where it was fortunate enough to secure a Bronze Medal. I can truthfully say that, so far, the results have far exceeded my most ambitious hopes, and I shall be quite satisfied if my next creation, Chas. Kennion's *Butch*, gives me as much pleasure.

Before closing these memoirs, I would like to join the hundreds of readers who have already expressed their appreciation of the pleasures derived from the pages of THE MODEL ENGINEER. The disappointment if it isn't in the post on Thursday morning ! I would also like to thank " L.B.S.C." for his contributions to our hobby. I am just a raw recruit to the steam dept. of model engineering, and I trust that any inferences or criticism I have made will be taken in good part. I have not attempted to establish any new laws, but I do hope that my observations have been of interest, and possibly some assistance to beginners or subsequent builders of the *Maid of Kent*.

Now for a few words in reply to the critics. I think on the whole J.N.M.'s remarks in his article " Locomotives at the ' M.E.' Exhibition " (October 1st, 1953, p. 388) were very kind. I agree the flat surfaces could have been flatter, and that the tender wheels were a disgrace. The latter were turned to the *Maid of Kent* blueprint, whereas the more correct machining of the engine wheels was prompted by an article appearing in THE MODEL ENGINEER at the time I was machining same (October 28th, 1948, pp. 448/449). I shall make sure next time ! I accept little responsibility for the position of the reversing lever, as this was fitted exactly as prescribed, and I do not see where else it could reasonably go and still be get-at-able. I certainly had no idea that Southern lettering was yellow. Doubtless I must have seen some of the Southern steam locomotives in days gone by; but in those days, I never expected to be building a miniature at some later date, and am afraid I did not take sufficient notice. But don't forget, J.N.M., I did write to your Query Dept., asking for assistance, and whilst giving me certain specific information regarding painting as requested, you did say that as far as you were aware there was no publication available giving details of colouring. So no one can say I didn't try.

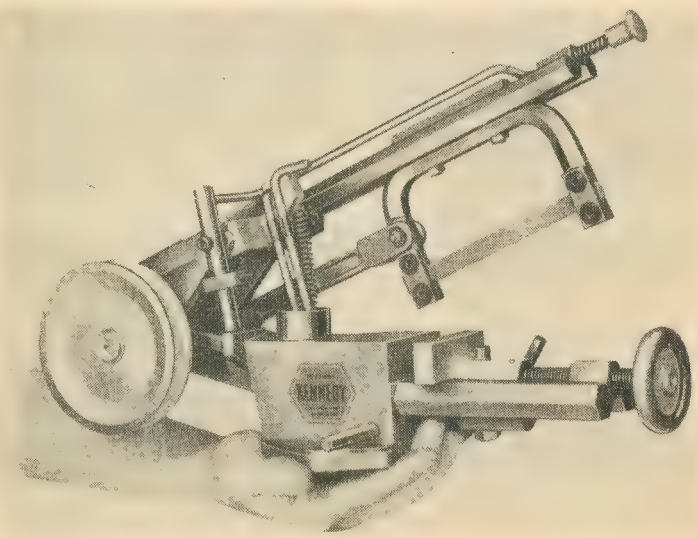
Lastly, a few words of encouragement to would-be exhibitors at future " M.E." Exhibitions. Don't be discouraged at the rude things people may say about your precious model. It is easy to pick holes in other people's work, but I have found to " have a go " is the quickest and best method of learning; most people, I am glad to say are only too willing to give a helping hand. My effort was a first attempt, and although it seems to have been torn to shreds in some quarters, it still goes well, and I'm proud of it.

The " Kennedy " Power Hacksaw

A VERY ingenious miniature hacksaw machine has recently been introduced by Messrs. W. Kennedy Ltd., Station Works, West Drayton, Middlesex. It comprises a die-cast alloy body, incorporating phosphor-bronze bearings, which carry a hardened and ground crankshaft. The saw frame, sawing arm and sliding ways of the vice which holds the work are all made from hexagonal steel bars, the arrangement of which is the subject of a patent. Any type of blade can be fitted, including broken lengths of blade from 6 in. upwards; no tension is applied to the blade, which is instead rigidly clamped at each end by plates secured by Allen screws. No weights are used to load the saw, pressure being applied by a spring, with a dashpot which relieves the cut on the back stroke.

The maximum capacity of the machine is 2 in. diameter, for either round or square bar or tube, or 2 in. by 2 in. angle section. It can be supplied complete with 1/6 h.p. electric motor, belt-coupled, and provided with belt-guard, switch and power cable, or alternatively, a non-powered version with 4½-in. belt pulley, is available.

This machine will be on display for the first time at the British Industries Fair, Birmingham, on May 3rd. The manufacturers will be remembered by many of our readers in connection with the ingenious bending appliance which has been demonstrated on two occasions at the MODEL ENGINEER Exhibition, and they have since developed and produced several other bending devices for special purposes.



READERS' LETTERS

RELIEVING MILLING CUTTERS

DEAR SIR,—In the issue of THE MODEL ENGINEER dated June 11th, 1953, on page 716, Mr. F. L. Carrig (Melbourne, Aust.), describes a relieving slide, and from the cutters, etc., shown in the photograph, this appears to be a very desirable tool; but to me the most important part of the outfit is the form tools that are used. Take for instance the relieving of a gear cutter (say a 20 d.p. No. 3), the making of a form tool for this, would be a very highly skilled job unless one had a similar cutter to produce it. The method employed by "Duplex," which I have produced and used with perfect results, could not be used on this slide, owing to the depth of tool; radius cutters, backing off, and angular cutters, do not present the same difficulties.

Years ago, "The Rivett Lathe Manu. Coy. of America," produced an attachment similar as regards the slide part, but cam-driven; this was geared to the mandrel, so that the number of dips corresponded to the number of teeth wanted on cutter.

The "Duplex" system only applies to gear cutters, but what about other types of cutters? I am more than interested in the production of these, as I have lately been experimenting in cutting spiral gears on a vertical miller; but if you do the lot from start to finish, it takes more tools to make a pair of gears, than it does to make a model traction engine or a locomotive.

All these cutters are very expensive, and I would like to see a good deal more information published about making cutters, etc. It is a great pity that the article did not go further and describe the types of form tools used. Having to dip into the milled slots, they must be pretty slender on the cutting edge, to get down without fouling the front of the tooth behind.

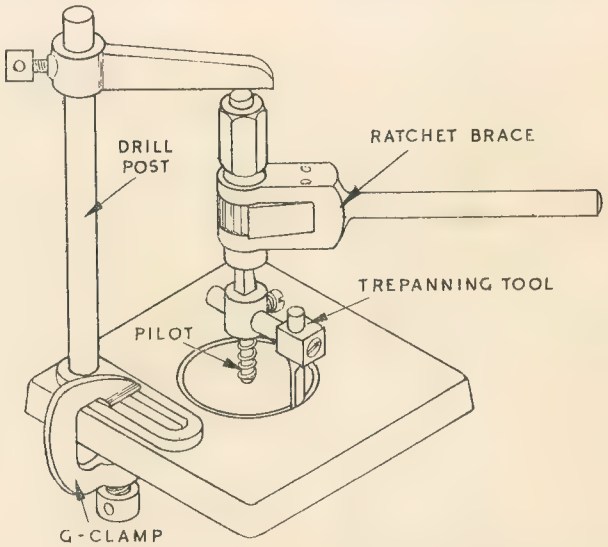
Yours faithfully,

Taunton. F. G. BETTLES.

A DRILLING PROBLEM

DEAR SIR—While the articles by "Duplex" are very instructive, and the workmanship which these contributors put into the specimens described is beyond criticism, it would appear that they never believe in using a simple and direct method of doing a job while it is possible to do it in a more complicated and elaborate way.

Take, for instance, the operation illustrated in their article "A Drilling Problem," in the issue dated March 25th, where a most elaborate power drilling set-up is employed to drill a circle of holes, which are afterwards broken out and filed to produce a large hole. I submit that this could be done quicker and more accurately by a simpler method, using primitive tools, and the sketch shows how our grandfathers would have tackled it.



The sketch is largely self-explanatory, but it may be observed that the tools are of a type which have formed an essential part of the fitter's or millwright's tool kit for upwards of a century. As shown, the drill post is clamped to the work by an ordinary boiler-maker's G-clamp, and its top arm adjusted to line up the point of the ratchet drill with the centre of the hole to be drilled. After drilling a hole to take the pilot, usually about ¼ in. diameter, a trepanning tool or "tank cutter" is fitted to the ratchet brace, and the cutting tool adjusted to the required radius of the large hole. A fairly stiff spring slipped over the pilot will steady the cut and help to avoid digging in.

If the underside of the work is ribbed or webbed, the projections can be cut through with a narrow cross-cut chisel as soon as the tool starts to break through. This method will produce a clean, perfectly circular hole, which requires nothing more than de-burring, instead of the considerable amount of filing which is called for by the "Duplex" method, to produce a hole of dubious accuracy.

Having had to use this method on many occasions in the most inaccessible places, such as the holds of ships and even inside boilers, I can guarantee that it works. Where there is plenty of elbow room, a ratchet brace is not necessary, as the cutter can be turned by means of a spanner or tap wrench, so long as it has some means of locating the point centre and applying end feed.

And the moral of this is: Don't throw away grandfather's tools, or his methods—they may be rusty, but they are still serviceable!

Yours faithfully,

"OLD-TIMER."

HOT AIR ENGINES

DEAR SIR,—The articles that appear from time to time on the above subject, are always both interesting and instructive. All the recent designs are Stirling engines. There are, of course, other possible cycles of operation, using modern materials and lubricants.

Mr. J. W. Corbett gives us a fine, clean, design in the issue of February 18th, of a "straight four" Stirling.

Some years ago I obtained a set

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

of " Corvus " castings, etc. from Mr. Corbett. A single, vertical two-crank engine, ⅝-in. bore by 1 in. stroke. I duly machined it up and had great fun with it. It would do, as Mr. Corbett said it would, over 1,000 r.p.m. running light. Wishing to see what it would do under load, a rope brake was rigged up. The " rope " consisted of a piece of sewing thread, the pull taken by a letter-balance, the load being applied by a miniature shot bucket. The brake drum was the flywheel boss. Revs. were counted by means of a simple stroboscope. The power curve rose from nothing at 1,100 r.p.m. to about 20 ft. : lb. : per min. at 550 r.p.m. Further loading decreased the power slowly. Has Mr. Corbett, or anyone else, any figures ?

Mr. H. E. Rendall, in the issue of November 26th, gives another aspect of the Stirling engine. Here, compressed air fills the whole system and, of course, much greater heat transfer can take place between the source of heat and the working gases. I must confess that I was quite unaware that Dr. Stirling had ever constructed such an engine. The performance figures are impressive. But from my own figures, and those given by Mr. Rendall, it would appear that the Stirling cycle is essentially conducive to low revs. per minute.

Has Mr. Rendall any thoughts of designing a miniature Stirling on the lines of his article ? A very pretty problem ! I would dispute his idea of any valve governing events. There is, as he says, a heat loss, which takes place, by virtue of the air passing to the working cylinder having to pass the water-cooled end. But why let it do so ? Surely, if we take the air through a " nozzle " somewhat removed from the cold end we avoid this loss. I think the displacers should be long, and a fairly close fit in the cylinder. They may be made of dural machined from bar, grooved longitudinally to promote heat exchange, hollowed for lightness and plugged. Where the port or nozzle occurs, the bore can be enlarged to prevent wiredrawing.

In an engine employing " densified " air, the minimum appears to be two displacers, one double-acting cylinder and a small air pump to maintain the air pressure. Piston-rod guides should be long and well-fitted. The working piston should also be long and lapped in, with oil grooves. Piston alloy would, probably be best, though dural would probably serve.

Yours faithfully,

Newark. B. J. CAFFERATA.

WEIR-TYPE PUMP

DEAR SIR,—I have been greatly interested in the small Weir-type donkey pump built by Mr. L. A. Burville of Eastbourne as mentioned in THE MODEL ENGINEER for December 31st, 1953.

I would like to build a similar pump for a 3½-in. gauge *Juliet*, and would be very glad to obtain from Mr. Burville—either through THE MODEL ENGINEER or by correspondence—a detailed description with dimensions of the pump itself, and particulars of the " plumbing " and provisions made for lubrication.

Mr. Burville seems to have been very successful in building and installing a pump that will run very slowly, and I would like to be able to get similar results.

Yours faithfully,

Victoria, Australia. L. R. EAST.

APPRENTICE TRAINING

DEAR SIR,—Having read the article in the March 18th issue about the apprentice training scheme at Harvey's of Greenwich, I would like to inform you of the scheme (run on similar lines, but on a larger scale as far as machinery is concerned) that is being very successfully applied at the Royal Ordnance Factories, Woolwich.

The Apprentice Training Shop R.O.F. Woolwich is a credit to the apprentice supervisory board, the foreman, the instructors, in fact anybody who has had anything to do with the running and upkeep of this shop.

Boys in this shop make a kit of tools, the average time taken being seven months. When finished, these tools are marked and examined, marks being allotted for each tool; the total marks possible being 100.

When an apprentice has finished his tools he is put through a series of production sections, which are as follows:

(1) Light Turning. (2) Heavy Turning. (3) Light Milling. (4) Heavy Milling. (5) Fitting. (6) Surface Grinding. (7) Rotary Grinding. (8) Shaping. (9) Slotting. (10) Millwrighting.

The average time spent by each apprentice in the shop is two years, and studies are continued at Woolwich Polytechnic, South East London Technical, and Dartford Technical, one day per week. Courses taken are Nationals and City and Guilds.

There are twelve instructors all experienced in their own particular trade.

There is also a lecture room equipped with devices for making instruction more readily absorbed by the youthful mind.

I have left the training shop now, and I am very clear as to the trade I wish to follow (universal grinding).

I will be pleased to supply any prospective entrant into the Royal Arsenal with information regarding the training scheme.

Yours faithfully,

Eltham. M. EDGAR.

[An article on this subject is in course of preparation.—ED. " M.E."]

TO LATIN SCHOLARS

DEAR SIR,—A few weeks ago I spent a couple of very pleasant hours indeed clambering over a 10-ton traction engine, built by The Wantage Engineering Co. Ltd. On the smokebox door is the usual circular cast nameplate which in this make, however, includes the Latin phrase " Astra Castra Numen Lumen."

I am informed by a young lady still at school that this means " Stars Camps Order Light." I feel sure somehow that there must be more to it than that and scent a story somewhere. Can any readers enlighten me further ?

Yours faithfully,

Sevenoaks. M. LAWSON FINCH.

DANGEROUS FUMES

DEAR SIR,—In recent Readers' Letters, the use of carbon tetrachloride has been a topic. This substance is widely used in industry as a solvent, degreaser and paint remover. It is sold every day, under various trade names, to use in the home for cleaning clothes. Some types of fire extinguisher are also charged with carbon tetrachloride.

C.T.C. is quite safe when properly used, but when misused can be extremely dangerous. The liberation of dangerous decomposition products will take place when C.T.C. comes in contact with a flame, but the greatest danger exists in the vapour. Brief exposure to a concentration of 1,000 parts per million in the atmosphere may result in death due to respiratory or cardiac failure. In 1951 the *British Medical Journal* reported the poisoning of a boiler-maker, working in an enclosed space below a carbon tetrachloride spray which was being used to remove paint.

It is essential that any process likely to increase the vapour content of the atmosphere, such as heating, should be avoided or carried out in very well ventilated conditions.

Yours faithfully,

Kent. " CARBO."

WITH THE CLUBS

The Kent M.E.S.

The society is once again moving its meeting place from Brownhill Road School to Hither Green School, Beacon Road, S.E.6.

A newly equipped workshop has been placed at our disposal, and the move should be beneficial. The school is within a few minutes walk of Hither Green B.R. Station. and also the No. 36 bus terminus. Regular meetings will commence on Friday, April 30th, from 7.30 p.m. to 10 p.m. Visitors are always welcome without prior invitation.

Hon. Secretary: F. H. GRAY, 73, Sangley Road, Catford, S.E.6.

Tonbridge M.E.S.

At a recent monthly meeting we were treated to a film show provided by our good neighbours the Maidstone Club, among whom were Mr. W. Bonnert, president and Mr. P. Wallis, chairman. The show consisted of a colour-film of Mr. Leigh-Pemberton's famous track, a film lent by British Railways portraying methods of locomotive overhauling and, lastly, shots of the Maidstone track in course of construction. At the conclusion our chairman, Mr. H. Mills called on those present to signify their appreciation in the usual manner.

Mr. Maskelyne has promised to visit our track on May 8th and members are asked to make a special effort to be present.

Hon. Secretary: R. H. PROCTER, "Roslyn," Coldharbour Lane, Hildenborough, Kent.

South London M.E.S

The next meeting of the society will be held at the White Horse Hotel, Brixton Hill, S.W., on Sunday, May 2nd, at 11 a.m., when Mr. Rowland will describe some methods he has used in the construction of his new locomotive.

The 'Hearn' cup competition for the best model of the year was jointly won by H. Philpot for his locomotive and R. A. Phillips for his speed boat, both models of the highest class workmanship and finish.

At the A.G.M. Messrs. R. L. Pennington and V. Wattingham were elected as committee men in place of the two retiring members.

Full particulars of membership can be obtained from the hon. secretary: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Eltham & District Locomotive Society

The next meeting will take place at the Beehive Hotel, Eltham, at 7.30 p.m., on Thursday, May 6th, which will be a rummage sale. This session is again by popular request, and members are asked to bring along their bits and pieces, which they wish to dispose of.

At the last meeting we had a splendid show of locomotives, under construction, and great thanks are due to Mr. Overton, and Mr. Judd in arranging and dealing with the transport. Mr. Hutton, the chairman, showed the chassis of his 3½-in. gauge locomotive, a beautiful piece of craftsmanship which was greatly admired, Mr. T. Powell and son their 5-in. gauge tank locomotive, which is nearing completion; Mr. A. Brook, the tender chassis of his 5-in. gauge Adams and Mr. S. Brock the tender and chassis of his 3½-in. gauge locomotive; Mr. Card his completed 3½-in. gauge, tank *Tich*. Altogether there was a wonderful show of work by the society's members which promises well for the addition to the club's stud of passenger-haulers There will be a club day at the permanent track at Avery Hill Road, Eltham, with a view to trials of locomotives, fitting them for a busy season on Saturday, May 8th. Visitors are always cordially invited to the meetings.

Hon. Secretary: F. H. BRADFORD, 19 South Park Crescent, S.E.6.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

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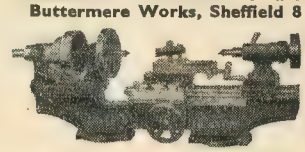

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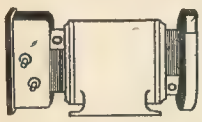

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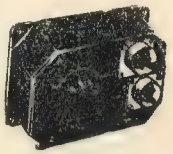

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MOTORS. Klaxon small d.c. 1/20 h.p., shunt, enclosed with extended shaft 220 volts, **15/-.** 1/50 h.p., **12/6,** post 1/6. 12 volt d.c. 1/25 h.p. 3,000 r.p.m., **21/-,** post 1/6.

TRANSFORMERS. Double wound 230 volts input 12 volts 8 amp. output, **30/-,** post 2/-. 12 volts 60 amp. open with heavy copper connections, **£10,** carr. 5/-. 53 volts 15 amp. terminal block cnnnections **£6 10,** carr. 5/-. 110 volts 500 watts shrouded **£12 10,** carr. 7/6, all for 230 volts 50 cycles input.

SLIDER RESISTANCES. We make sliders for all purposes, enamelled steel tubes wound nichrome wire fitted laminated brush gear, send us your enquiries. Stock sizes 5 ohms, 10 amp, **27/6.** 6.5 ohms to 5 amp., **25/-.** 290 ohms, 0.45 amp., **17/6.** 1 ohm, 12 amp., **12/6.** Dimmer resistances for stage lighting. Write for special list.

DYNAMOS. 12 volts, 29 amp., 3,000 r.p.m., fan cooled by Newton spline shaft, clockwise rotation, 350 watts, **75/-,** carr. 5/-. 50/68 volts, 10 amp. 500 watts, **£12 10,** carr. 10/-. 12 volts, 10 amps., 1,400 r.p.m., **55/-,** carr. 5/-.

METERS. A.C./D.C. moving iron ammeters all ranges to 30 amp. 2½" flush or projecting panel, **17/6,** volts all ranges to 30 volts, **17/6.** 5" Switchboard meters 300 volts and 50 amp., to match by Met Vick, **75/-** each.

HAND MAGNETO GENERATORS. Plessy type as new comprise P.M. steel magnet, wound armature driven by gearing in handle, 70 volts 25 m.a. a.c. output, **12/6,** post 1/6

LIQUID LEVEL INDICATORS new with ball float, **3/6,** post 1/-.

MOTOR PUMPS. Stuart Turner 12 volt d.c., lift 3 ft. throw 10 ft., capacity 100 g.p.h., **£7 10,** post 2/6. 230 volt a.c. model, **£7 10,** post 2/6. Larger size for 230 volts a.c., lift 5 ft., throw 20 ft., capacity 350 g.p.h., **£10 10,** carr. 3/6. Rotary suds pump, lift 8 ft., throw 35 ft., capacity 80 g.p.h., pump only with pulley, **£5,** carr. 2/6.

SWITCHES. 30 amp. double pole knife switches quick break on polished enamelled slate panel, **15/-,** post 2/6. Float switches for automatic operation, switch in iron box fitted mercury tube with instantaneous make and break complete with chain and float, **45/-,** post 2/6.

ELECTRADIX RADIOS

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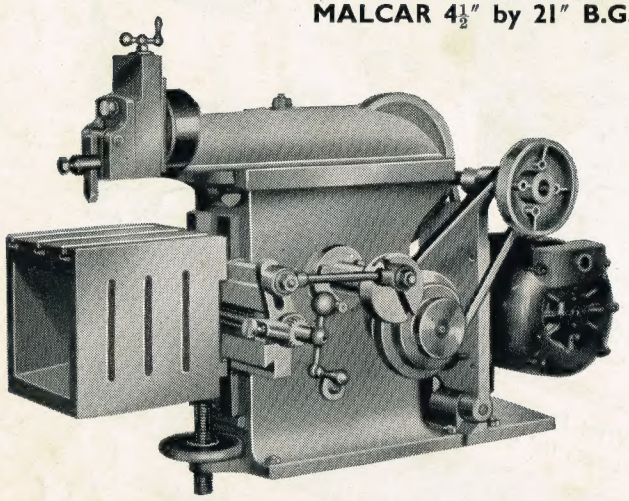
MALCAR 4½″ by 21″ B.G.S.C. LATHE



Here are the Machines you have been waiting for. Equally suited for the Home Workshop or Manufacturing Firm, and at the **RIGHT PRICE.**

SPECIFICATION

Stroke-Adjustable Maximum 7″.
Adjustable working Position of Ram
Speeds—35, 70 and 130 strokes per min.
Automatic and Reversible variable Cross Feed—.006 in. to .018 per stroke.
Length of Cross Traverse 8″.
Size of Table 6½″ × 6¾″.
Overall Height, Width and Length 18″ × 17″ × 27″.
Nett Weight 100 lbs.
Gross Weight Packed 120 lbs.
Approx. dimensions packed 30″ × 18″ × 20″
Size of Base 10½″ × 6½″.
Maximum distance between Ram and Table 5″.
Swivelling type Tool Holder and Graduated Swivelling Tool Head.
Effective travel of Tool Head—2″.
Transmission through vee belts and vee pulleys.
Powered by .25 h.p. motor, single or three phase (please state type of motor required).

Price £57.10.0 (less Motor **£52 0s. 0d.**) Hire Purchase deposit **£19 10s. 0d.** repayable by 12 monthly payments of **£3 8s. 8d.** Carriage 15/-.

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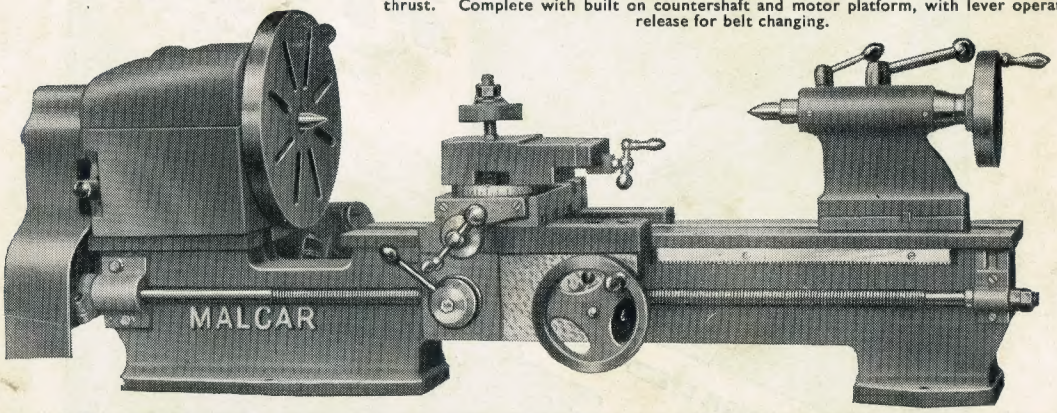

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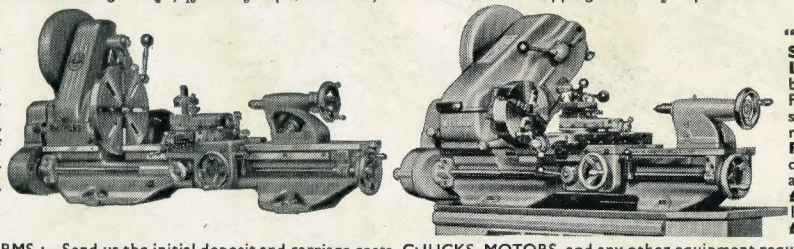

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